

HEALTH CARE AND POLICY INTERVENTIONS TO IMPROVE THE HEALTH OF
PATIENTS EXPERIENCING HOMELESSNESS

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DEDICATION

To all who experience homelessness and other forms of social injustice.

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Elizabeth H. Golembiewski

HEALTH CARE AND POLICY INTERVENTIONS TO IMPROVE THE HEALTH OF PATIENTS EXPERIENCING HOMELESSNESS

Housing instability and homelessness are associated with significant health burdens, including high rates of chronic and infectious disease, disproportionate vulnerability to violence and injury, and increased risk of premature death and disability. In addition, between 28-57% of nonelderly homeless adults lack health insurance coverage. Consequently, homelessness is associated with reduced access to outpatient primary care services and increased rates of emergency department (ED) visits, which are costly and inefficient for both health systems and patients. In the context of mounting emphasis on value-based reimbursement structures, health systems and policymakers have a vested interest in reducing high-cost utilization and addressing social determinants of health, including housing.

Therefore, in this dissertation, I address three research questions at the intersection of housing needs and the United States health care delivery system. The first study is a systematic review of the peer-reviewed literature evaluating interventions to reduce ED utilization among adults who experience homelessness. The second study uses state-level panel data to examine the impact of Medicaid expansion on rates of adult homelessness by comparing states that opted to expand their Medicaid eligibility requirements under the Affordable Care Act (ACA) with states that did not. Finally, the third study uses multiple years of national data to assess clinical quality performance among a subset of federally qualified health centers that received Health Care for the

Homeless (HCH) funding from 2014-2017 to provide homeless-tailored primary care services.

Key findings include the need for larger, more generalizable studies with rigorous designs to assess the effectiveness of strategies to reduce ED use among homeless patients; expanding Medicaid eligibility may mitigate the impact of large or unexpected medical expenses among families with children who are at risk of homelessness; and finally, HCH-funded health centers have demonstrated improvements on several clinical quality indicators over time and have distinct organizational characteristics that are associated with performance on these indicators. Collectively, these studies sought to answer timely health policy and management questions about individuals who experience housing needs, a group that comprises one of the most under-resourced and socially disadvantaged patient populations in the United States.

Christopher A. Harle, PhD, Chair

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LIST OF ABBREVIATIONS

ACA: Patient Protection and Affordable Care Act

CoC: Continuum of Care

EHR: Electronic health record

FPL: Federal poverty level

FQHC: Federally qualified health center

HCH: Health Care for the Homeless

HPI: Housing Price Index

HRSA: Health Resources and Services Administration

HUD: Department of Housing and Urban Development

SD: Standard deviation

SE: Standard error

UDS: Uniform Data System

PRISMA: Preferred Reporting Items for Systematic Review and Meta-Analyses

VA: Department of Veterans Affairs

VHA: Veterans Health Administration

CHAPTER 1: INTRODUCTION

Homelessness and Housing Instability in the United States

In recent years, the focus of the United States health care delivery system has reoriented from the provision of tertiary medical care, in which patients are treated for existing illness or injury, to a prevention-based model that promotes the widespread use of primary care services and attention to social factors that influence health (Fani-Marvasti & Stafford, 2012). Few social determinants impact health status more than housing. For example, inadequate housing conditions, including structural deficiencies, lack of temperature regulation, infestations, and the presence of hazardous materials such as lead and asbestos, are associated with a host of serious health issues in adults and children (Shaw, 2004). In addition, household overcrowding has been linked to negative psychosocial impacts on mental health, parent-child communication, social relationships, and sleep (Cutts et al., 2011; Evans, Lepore, Shejwal, & Palsane, 1998; Gove, Hughes, & Galle, 1979). Finally, frequent involuntary changes in housing, common among low-income individuals and families, can interfere with stable employment (Böheim & Taylor, 2002) and contribute to family and social disruption (Astone & McLanahan, 1994; Jelleyman & Spencer, 2008).

Homelessness, a state in which an individual or family lacks a stable, permanent nighttime residence, represents the extreme on the continuum of housing needs. Nearly 600,000 adults and children were homeless on a single night in 2017 in the United States (Henry, Watt, Rosenthal, & Shivji, 2017), while an estimated 2.5-3.5 million people experience homelessness annually (Burt, 2001). In addition, approximately 4.2% of Americans have experienced homelessness at least once in their lifetime (Tsai, 2017).

The homeless population is diverse and touches an already-marginalized cross-section of American society. For example, one-fifth of homeless persons are children under 18 years of age (Henry et al., 2017). Although the majority (61%) of homeless adults in the United States are men, female-headed families make up about one-third of the total homeless population (Henry et al., 2017). Black individuals and families have consistently been overrepresented among the homeless (Burt, 2001; Culhane & Metraux, 1999), amounting to over 40% of the homeless population but comprising only 13.4% of the US general population (US Census Bureau, 2017; Henry et al., 2017). In addition, military veterans constitute about 12% of the adult homeless population in the United States (Henry et al., 2017).

Homelessness is a dynamic, often temporary condition, and no single, fixed definition of homelessness exists (Lee, Tyler, & Wright, 2010; McAllister, Lennon, & Kuang, 2011). For the purpose of determining homelessness assistance eligibility, the US federal government first defined homelessness in 1987 under the McKinney-Vento Homeless Assistance Act, the first comprehensive legislation to address homelessness in the United States (The McKinney–Vento Homeless Assistance Act, 1987). The original federal language defined individuals or families who experience homelessness as those who “lack a fixed, regular, and adequate nighttime residence”; whose “primary nighttime residence is a public or private place not designed for or ordinarily used as a regular sleeping accommodation for human beings, including a car, park, abandoned building, bus or train station, airport, or camping ground”; or who are “living in a supervised publicly or privately operated shelter designated to provide temporary living arrangements” (The McKinney–Vento Homeless Assistance Act, 1987). In 2009, the

Homeless Emergency Assistance and Rapid Transition to Housing (HEARTH) Act broadened the federal definition of homelessness to include individuals and families who are “doubled up” (i.e., living with family or friends out of financial necessity), who do not have a stable housing situation after release from prison or a hospital, or who are otherwise at imminent risk of becoming homeless (Homeless Emergency Assistance and Rapid Transition to Housing Act, 2009).

Homelessness severity is commonly organized by frequency and duration into one of three mutually exclusive categories: 1) transitional homelessness, or 1-2 relatively brief homeless episodes; 2) episodic homelessness, characterized by many homeless episodes of short duration, and 3) chronic homelessness, experienced by unaccompanied individuals with a physical or mental disability who have been continuously homeless for a year or more, or have had four or more episodes of homelessness in the past three years (Culhane, Metraux, Park, Schretzman, & Valente, 2007; Kuhn & Culhane, 1998). Although different classification schema for homelessness have been proposed (Danseco & Holden, 1998; Kuhn & Culhane, 1998; McAllister et al., 2011), this three-category typology is widely used by government (Mangano, 2003; Rickards et al., 2010) and non-profit organizations (Cunningham, 2009) to determine policy priorities and funding allocation. The federal government additionally classifies homeless families and individuals based on current living arrangement as “sheltered” (i.e., staying in emergency shelters, transitional housing programs, or safe haven sites, or doubled up with family or friends) or “unsheltered” (i.e., maintaining a primary nighttime residence in a place not ordinarily used as a regular sleeping accommodation for humans, such as the streets, vehicles, or parks) (Henry et al., 2017).

Like homelessness, the closely related concept of housing instability—sometimes called “housing insecurity” or “residential instability”—has no single fixed definition (Frederick, Chwalek, Hughes, Karabanow, & Kidd, 2014; Kushel, Gupta, Gee, & Haas, 2006). Housing instability generally refers to housing needs short of homelessness that include but are not limited to trouble paying rent, mortgages, or utilities; frequent moves; living in overcrowded conditions; and spending a majority of household income on housing (Desmond, 2012; Frederick et al., 2014; Gilman, Kawachi, Fitzmaurice, & Buka, 2003; Kushel, Gupta, et al., 2006; Phinney, Danziger, Pollack, & Seefeldt, 2007). In any of its myriad forms, housing instability is a precursor to homelessness (McChesney, 1990; Shinn & Gillespie, 1994; Shinn et al., 2007), and most people who are homeless have previously experienced one or more periods of housing instability (Reid, Vittinghoff, & Kushel, 2008; Sosin, 2003). There is limited population-level data on housing instability, but estimates suggest that approximately one-quarter of low-income adults in the United States have trouble paying rent, mortgages, or utilities (Kushel, Gupta, et al., 2006).

Causes of Homelessness

Determining risk factors for homelessness has been of interest to researchers and policymakers since the mid-1980s, when homelessness first rose in visibility and became a mainstream social concern in the United States (Ficenec, 2011). It is generally accepted that homelessness results from a convergence of structural and individual-level factors that create barriers to finding and maintaining stable housing. Structural or macro-level factors that influence rates of homelessness include: housing market factors, such as

housing affordability and availability (Burt, 2001; Koegel, Burnam, & Baumohl, 1996; Main, 1996; Malpezzi & Green, 1996; Quigley & Raphael, 2004; Wright & Lam, 1987) and rent levels (Bohanon, 1991; Early & Olsen, 2002; Honig & Filer, 1993; Lee, Price-Spratlen, & Kanan, 2003; Troutman, Jackson, & Ekelund, 1999); economic conditions, including poverty and unemployment rates (Applebaum, Dolny, Dreier, & Gilderbloom, 1991; Bohanon, 1991; Burt, 1992; Early & Olsen, 2002; Quigley & Raphael, 2001; Troutman et al., 1999) and income inequality (Mansur, Quigley, Raphael, & Smolensky, 2002; O'Flaherty, 1995); and generosity of social safety net programs intended to serve low-income populations, including the Supplemental Nutrition Assistance Program (SNAP) and Temporary Assistance for Needy Families (TANF) programs (Burt, 1992; Honig & Filer, 1993; Quigley & Raphael, 2001, 2004; Troutman et al., 1999). In contrast, factors that increase susceptibility to homelessness at an individual-level have been widely evidenced, and include physical disability (Shlay & Rossi, 1992), serious mental illness (Folsom et al., 2005), drug or alcohol misuse (Edens, Kaspro, Tsai, & Rosenheck, 2011; Johnson, Freels, Parsons, & Vangeest, 1997), and lack of social capital or support (Kingree, Stephens, Braithwaite, & Griffin, 1999; Shinn et al., 2007; Slesnick, Bartle-Haring, Dashora, Kang, & Aukward, 2008). Most contemporary theoretical models of homelessness treat structural and individual-level determinants as complementary factors that are necessary but not alone sufficient in contributing to and perpetuating homelessness (Byrne, Munley, Fargo, Montgomery, & Culhane, 2013; O'Flaherty, 1995).

In particular, poor health is both a cause and consequence of homelessness (Wright, 1990). Lack of housing can exacerbate poor health, increase susceptibility to

additional health concerns that may include injury, exposure, and communicable disease, and creates barriers to attaining health care services and treatment. Conversely, the physical and financial costs associated with poor health contribute to unemployment and financial catastrophe, which are antecedents of homelessness (Elliott & Krivo, 1991). Moreover, in the United States, where health insurance coverage for adults has largely been employer-based, job loss is often accompanied by loss of health insurance. Furthermore, an estimated 62.1% of US personal bankruptcies result from medical bills (Himmelstein, Thorne, Warren, & Woolhandler, 2009). Some evidence suggests that health-related shocks directly precipitate homelessness. In one longitudinal study of low-income families, the birth of a child with a serious health condition significantly increased the likelihood of subsequent homelessness in that family, particularly in areas with unfavorable housing markets (Curtis, Corman, Noonan, & Reichman, 2013). Furthermore, health-related financial shocks have the greatest impact on those most vulnerable, as these are more likely to drive housing unstable individuals or families into homelessness than to drive the stably housed into housing instability (Curtis et al., 2013).

Measuring and Researching Homelessness

Despite an enduring interest since the 1980s in documenting the causes and consequences of homelessness in the United States, there remains a lack of population-based data by which to do so. The sole national census of homelessness is coordinated annually under Congressional mandate by the Department of Housing and Urban Development (HUD). HUD estimates of homelessness are grounded in two activities: 1) a “point-in-time” count of all sheltered and unsheltered homeless individuals and

families, conducted on a single, pre-determined night in January each year to avoid seasonal variations between sites, and 2) a housing inventory count of shelter bed usage over the past year (Henry et al., 2017). The official purpose of the annual HUD estimate is to inform legislative decision-making related to funding allocation, service delivery strategies, and to track trends in the extent and types of homelessness across states over time. However, HUD counts are by design an underestimate of the true magnitude of homelessness, as they exclude groups of individuals also considered homeless under the federal definition, including those who use privately funded shelters that do not receive HUD funding, are “doubled up” (i.e., living with friends or family out of necessity), do not have a stable housing situation after release from prison or a hospital, or are facing imminent eviction or other forms of housing instability (Stanley, 2017). In addition, the point-in-time counts conducted in January are coordinated and implemented by local agencies that provide homelessness assistance. Local counts are largely reliant on trained volunteers, which may result in differences in measurement quality across sites (Henry et al., 2017).

Despite its inherent flaws, the estimates provided by HUD each year are currently the most reliable and detailed national data available by which to measure the magnitude and composition of homelessness in the United States (Byrne et al., 2013). Prior to 2005, when the HUD counts were first implemented, large-scale approximations of homelessness were limited to 1) key informant estimates of the homeless population from local experts in 60 metropolitan areas throughout the United States (US Department of Housing and Urban Development, 1984) or 2) data from the 1990 decennial census, when

the US Census Bureau made a one-time effort to enumerate homeless persons at emergency shelters and outdoor locations in major cities (Martin, 1992).

Most nationally representative household surveys exclude, by design, unhoused persons from their sampling frame. In addition, the transient nature of homelessness is a barrier to survey respondent recruitment and follow-up because of the difficulties inherent in reaching a participant assumed not to have a fixed address or phone number. Other reasons for the exclusion of hard-to-access populations such as the homeless from national surveys include low population prevalence and lack of questionnaire applicability (Meltzer, 2010). Since a pattern of intermittent access to conventional housing is relatively common among episodically or transitionally homeless persons (Goering, Tolomiczenko, Sheldon, Boydell, & Wasylenki, 2002), cross-sectional studies that do include the homeless tend to over-sample chronically homeless persons (Link et al., 1994). Other efforts to collect data on homelessness have relied on the use of secondary databases of homeless service users maintained for administrative purposes (Byrne & Culhane, 2015).

Despite the influence of homelessness on health status and health care utilization, homelessness is not routinely documented in health care delivery settings. Health care providers may fail to document housing status for a variety of reasons, including stigma associated with homelessness, competing priorities during a clinical encounter, or the perception that health care providers are not equipped to adequately address housing concerns in the first place (Zlotnick & Zerger, 2009). Just half of homeless patients are asked by providers about their housing status (Greysen, Allen, Rosenthal, Lucas, & Wang, 2013), and only 15-22.5% of homeless patients are given administrative indicators

of homelessness in their medical record (Greysen et al., 2013; Ku, Scott, Kertesz, & Pitts, 2010; Tsai, Weintraub, Gee, & Kushel, 2005). In addition, there is wide variation in the application of administrative indicators of homelessness within and across health care settings (Peterson et al., 2015; Zech, Husk, Moore, Kuperman, & Shapiro, 2015).

The majority of nationally representative studies on homelessness and health care utilization rely on the National Ambulatory Medical Care Survey (NAMCS), which uses self-reported patient residence to classify homelessness into a binary variable (Brown & Steinman, 2013; Coe, Moczygemba, Harpe, & Gatewood, 2015; Ku et al., 2010; Salhi, White, Pitts, & Wright, 2018; Tadros, Layman, Brewer, & Davis, 2016). More comprehensive national data on homelessness is available in Veterans Health Administration (VHA) data (Byrne et al., 2015; Peterson et al., 2015), but only includes homeless individuals who are veterans and use the VHA system for care (Salhi et al., 2018; Stovall, Flaherty, Bowden, & Schoeny, 1997; Tsai, Doran, & Rosenheck, 2013). Many studies on patterns of health care utilization by the homeless therefore rely on single site or health system administrative data, chart review, or patient self-report (Chong et al., 2014; Ku et al., 2014; Kushel, Vittinghoff, & Haas, 2001; Pearson, Bruggman, & Haukoos, 2007; Schanzer, Dominguez, Shrout, & Caton, 2007).

Health Status and Health Care Utilization among Homeless and Unstably Housed Patients

Homelessness has been consistently and significantly associated with high rates of morbidity and mortality (Hastings et al., 2011; Kushel, Perry, Bangsberg, Clark, & Moss, 2002; Kushel et al., 2001; Salit, Kuhn, Hartz, Vu, & Mosso, 1998). Unadjusted for sex,

people who experience homelessness have a life expectancy between 42-52 years of age, compared to 79 years of age in the US general population (O’Connell, 2005). As documented over decades of research, age-adjusted rates of mortality are between 4 and 10 times higher among homeless individuals than among non-homeless residents of the same geographic area (Barrow, Herman, Cordova, & Struening, 1999; Hwang, Wilkins, Tjepkema, O’Campo, & Dunn, 2009; Kaspro & Rosenheck, 2000; Roncarati et al., 2018). In addition, recent evidence indicates that all-cause mortality rates among unsheltered homeless adults (e.g., individuals who sleep in open-air locations like parks, on sidewalks, and under bridges) are up to three times higher than those among homeless “sheltered” adults sleeping in shelters or transitional housing (Roncarati et al., 2018). Drug overdoses account for an estimated one-fifth of deaths among the homeless, with 80% of these attributable to opioids (Baggett et al., 2013). As in the US general population, cancer and heart disease are the leading causes of death among older homeless adults aged 45 years or older (Baggett et al., 2013).

Individuals who are homeless exhibit rates of all-cause morbidity 3-6 times higher than in the general population (Elvy, McAdam, Scharer, & Vicic, 1986; Gelberg & Linn, 1988; Martens, 2000; Zlotnick & Zerger, 2009), and middle-aged homeless adults often present to health care settings with medical concerns more consistent with those of late middle-aged or elderly patients who are not homeless (Gelberg, Linn, & Mayer-Oakes, 1990). Specifically, rates of mental illness, substance use disorder (including alcohol dependence), and co-occurring mental illness and substance use disorders are particularly high among persons who experience homelessness (Drake, Osher, & Wallach, 1991; Fazel, Khosla, Doll, & Geddes, 2008). In addition, chronic health conditions may be

untreated or inadequately managed among persons who experience homelessness, exacerbating the severity and disease burden of common health issues like diabetes, asthma, and hypertension (Gelberg, 1989; Hwang, 2001; Hwang & Bugeja, 2000). Homelessness is also associated with an elevated prevalence of health conditions relatively uncommon in the general population, including foot and skin conditions (Chen, Mitchell, & Tran, 2012; Stratigos & Katsambas, 2003; To, Brothers, & Van Zoost, 2016), injury (Fazel, Geddes, & Kushel, 2014; Hwang, 2001), and infectious diseases like tuberculosis (Sandgren et al., 2016), hepatitis C (Beijer, Wolf, & Fazel, 2012), and HIV/AIDS (Beijer et al., 2012).

Primary Care Access and Utilization

Despite high rates of disease, individuals who are homeless or unstably housed face significant barriers to accessing primary care services, which are intended to diagnose and manage a majority of personal health needs (Donaldson, Yordy, Lohr, & Vanselow, 1996). Access to routine primary care has been associated with reduced mortality (Jerant, Fenton, & Franks, 2012; Starfield, Shi, & Macinko, 2005), receipt of recommended preventive screenings (Shi, Starfield, Politzer, & Regan, 2002), and improved management of chronic disease (Bodenheimer, Wagner, & Grumbach, 2002). However, a majority of homeless adults lack health insurance coverage (Chwastiak, Tsai, & Rosenheck, 2012; Kushel et al., 2001) and report difficulties paying for primary care services (Chwastiak et al., 2012; Kertesz et al., 2014). With or without insurance, an inability to pay any out-of-pocket costs associated with health care discourages many homeless persons from acquiring primary care services (Chwastiak et al., 2012; Kertesz

et al., 2014). Beyond financial obstacles, homeless persons face many structural and psychosocial barriers to accessing primary health care services. Lack of reliable transportation is common among members of this population and may delay or prevent the utilization of routine, outpatient care (Kertesz et al., 2014; McGuire, Gelberg, Blue-Howells, & Rosenheck, 2009). Low levels of health literacy prevent many homeless individuals from navigating complex systems of care to obtain needed services (Doran, Vashi, et al., 2013; Kessell, Bhatia, Bamberger, & Kushel, 2006). Homeless individuals have also reported suboptimal experiences in primary care settings and a corresponding lack of trust in health care providers and organizations (O'Toole, Johnson, Redihan, Borgia, & Rose, 2015). Several studies have also identified the presence of competing needs related to being homeless as a significant barrier to primary care access, resulting in the prioritization of obtaining food, clothing, and shelter over health care (Baggett, O'Connell, Singer, & Rigotti, 2010; Chwastiak et al., 2012; Gallagher, Andersen, Koegel, & Gelberg, 1997; Gelberg, Gallagher, Andersen, & Koegel, 1997).

Less is known about the relationship between primary health care utilization and housing instability short of homelessness. However, evidence suggests that adults who are unstably housed have difficulty with chronic disease management because of issues related to obtaining necessary medications, making dietary modifications, and competing priorities related to food and shelter (Berkowitz, Kalkhoran, Edwards, Essien, & Baggett, 2018; Berkowitz et al., 2015; Vijayaraghavan, Jacobs, Seligman, & Fernandez, 2011). In terms of severity, the effect of housing instability on primary health care access has previously been quantified as a linear trend, with increasing severity of housing needs—from unstably housed, to formerly homeless, to currently homeless—associated with a

higher probability of being uninsured and postponing needed care (Reid et al., 2008). Specifically, adults and children who live in overcrowded homes are more likely to postpone medical care than those living in non-crowded, low-income households (Kushel, Gupta, et al., 2006; Ma, Gee, & Kushel, 2008), while homeless adults are more likely than adults living in overcrowded housing to postpone care (Kushel et al., 2001). Similarly, adults who are chronically homeless or have been homeless for more than five years are less likely than adults who have been homeless for fewer years to have a usual source of primary care (Gallagher et al., 1997; Stein, Andersen, & Gelberg, 2007).

Tailored, homeless-specific delivery models have shown some promise in improving access to primary care among the homeless. For example, VHA primary care clinics tailored to meet the needs of homeless veterans have been associated with increases in primary care visits, better chronic disease management, higher patient satisfaction, and fewer ambulatory-care sensitive emergency department visits compared to homeless veterans at standard clinics (Kertesz et al., 2013; McGuire et al., 2009; O'Toole et al., 2013; O'Toole et al., 2010; White & Newman, 2015). Outside of the VHA system, some federally qualified community health centers (FQHCs) receive targeted funding under the Health Care for the Homeless (HCH) program to serve the needs of individuals and families experiencing homelessness in their communities (Zlotnick, Zerger, & Wolfe, 2013). Despite a low-income patient base with complex medical and social needs, the federal health center program has improved access to care among medically underserved populations (Shi, Stevens, & Politzer, 2007) and has consistently demonstrated satisfactory levels of quality performance (Hicks et al., 2006; Proser, 2005; Shin, Sharac, Rosenbaum, & Paradise, 2013). However, among homeless patients

receiving care at an FQHC, a majority nevertheless reported 1-2 unmet health needs in the past year (Baggett et al., 2010).

Hospital and Emergency Department Utilization

As a result of barriers to accessing primary care services, homeless individuals are disproportionately more likely than non-homeless individuals to seek medical treatment in high-acuity, hospital-based settings (Gelberg et al., 1997; Hall, Choi, Himmelfarb, Chertow, & Bindman, 2012; Kangovi et al., 2013; Kushel et al., 2001; Lang et al., 1997; Mackelprang, Qiu, & Rivara, 2015; Poulin, Maguire, Metraux, & Culhane, 2010), many of which in the United States are obligated as a community resource to provide care regardless of a patient's ability to pay (Gelberg et al., 1997; Kushel et al., 2002; Tadros et al., 2016). Specifically, homelessness has been shown to be an independent risk factor for emergency department utilization (Amato, Nobay, Amato, Abar, & Adler, 2018; Hwang et al., 2013; Lebrun-Harris et al., 2013). Between 30-40% of homeless adults in the United States have received care in the emergency department at least once in the past year (Kushel et al., 2002; Kushel et al., 2001), compared to less than one-fifth of the US adult general population (Hing & Rui, 2016). Homeless patients are also more likely than non-homeless patients to present to the emergency department with low-acuity, non-emergency medical needs (Han & Wells, 2003; Ku et al., 2010), return within 72 hours (Mackelprang et al., 2015; Tadros et al., 2016), and present to the emergency department within seven days of hospital discharge (Doran, Vashi, et al., 2013; Tadros et al., 2016). Compared with housed patients, homeless patients are more likely to arrive by ambulance to the emergency department (Coe, Moczygemba, Harpe, et al., 2015; Ku et al., 2010;

Oates, Tadros, & Davis, 2009). In addition, the cost of emergency department visits and subsequent hospitalizations among patients who are homeless is estimated to be 3.8 times that of non-homeless Medicaid recipients (Bharel et al., 2013).

Individuals who are homeless are also hospitalized at higher rates than people who are not homeless (Salit et al., 1998). On average, homeless patients have longer and costlier lengths of stay in the hospital than patients without documented evidence of homelessness (Hwang, Weaver, Aubry, & Hoch, 2011). In addition, homeless individuals are more frequently admitted to the hospital for reasons considered preventable or ambulatory care-sensitive (Buck, Brown, Mortensen, Riggs, & Franzini, 2012; Kerker et al., 2011; Lin, Bharel, Zhang, O'Connell, & Clark, 2015; White, Ellis, Jones, Moran, & Simpson, 2018). Homeless individuals are also 2-4 times more likely than patients with housing to be readmitted to the hospital after initial discharge for an unplanned reason (Lam, Arora, & Menchine, 2016; Saab, Nisenbaum, Dhalla, & Hwang, 2016), with all-cause readmission rates estimated at 21.2-50.8% in community-based samples from different cities in the United States and Canada (Buck et al., 2012; Doran, Ragins, Iacomacci, et al., 2013; Kertesz et al., 2009).

Reliance on hospital-based utilization among patients who are homeless is problematic for health systems for several reasons. For instance, emergency department utilization is costly compared with outpatient ambulatory care, and many emergency department visits can be avoided with routine preventive primary care (Bharel et al., 2013; Kangovi et al., 2013; Kushel et al., 2002). Further, because emergency departments are not intended to provide routine continuity care, the use of emergency services for ambulatory care-sensitive conditions is inefficient and may negatively impact patient

outcomes (Sandoval et al., 2010). In addition, spending on inpatient hospital care accounts for nearly one-third of overall national health expenditures (Centers for Medicare and Medicaid Services, 2018), and adult patients with at least one readmission per calendar year have annual hospital costs exceeding twice that of patients with no readmissions (Friedman & Basu, 2004). Finally, preventable hospitalization and readmission rates are also widely used markers of hospital quality, because many readmissions are avoidable through organizational and provider-level activities, such as adequate care coordination among providers during and after hospitalization and sufficient communication around patient discharge instructions (Ahmad, Metlay, Barg, Henderson, & Werner, 2013; Jack et al., 2009).

The Role of Health Insurance

Among homeless persons, health insurance coverage has been associated with increased primary care access (Kushel et al., 2001; Stein et al., 2007), having a usual source of primary care (Chwastiak et al., 2012; Gallagher et al., 1997), and increased use of preventive services (Stein et al., 2007). However, people who experience homelessness are uninsured at high rates, even when compared to low-income individuals with housing (Oates et al., 2009). An estimated 28-43% of nonelderly homeless adults lacked any type of health insurance before health care reform legislation was passed in 2010, nearly twice the proportion of uninsured adults in the general population (Karaca, Wong, & Mutter, 2013). Even among patients connected to a usual source of primary care through federally funded HCH health centers, an estimated 57% were uninsured prior to the beginning of Medicaid expansion in 2014 (DiPietro, Artiga, & Gates, 2014).

Among non-veterans, homeless patients who do have health insurance are most likely to be covered under state Medicaid programs (Karaca et al., 2013). Additionally, although the Department of Veterans Affairs (VA) runs a health system specifically for veterans, not all veterans qualify for health benefits and nearly one in ten nonelderly adult veterans are covered by Medicaid as their primary health insurance instead (Artiga, DiPietro, & Ubri, 2017).

However, with the passage of the Affordable Care Act (ACA) in 2010, the widespread expansion of Medicaid eligibility requirements in many states provides new insurance options for vulnerable populations, including people experiencing homelessness, and hopes for a reduction in the high financial burden of medical care in the United States (Baird, 2016). The impact of health insurance on financial and housing stability has been well documented. In the landmark 2008 experiment in Oregon, low-income households gaining access to Medicaid through a statewide lottery system had significantly lower medical debt (including fewer medical bills sent to collection) and overall lower out-of-pocket spending on medical expenses (Finkelstein et al., 2012). Conversely, participants with lost or disrupted Medicaid coverage in the same experiment were twice as likely to report medical debt compared to those continuously insured after controlling for demographic characteristics, income, and health status (Carlson, DeVoe, & Wright, 2006). Similarly, other studies have documented the impact of gaining health insurance on a variety of desirable financial outcomes, including less difficulty paying medical bills (Barcellos & Jacobson, 2015; Hu, Kaestner, Mazumder, Miller, & Wong, 2016), lower personal bankruptcy rates (Gross & Notowidigdo, 2011; Hu, Kaestner, et al., 2016; Mazumder & Miller, 2016), improved credit scores (Mazumder & Miller,

2016), lower out-of-pocket medical expenditures (Barcellos & Jacobson, 2015), and lower overall debt (Gross & Notowidigdo, 2011; Hu, Kaestner, et al., 2016; Mazumder & Miller, 2016).

Medicaid expansion is potentially significant for the homeless population in particular. First, uptake of Medicaid coverage in expansion states has been high, both generally (Mazurenko, Balio, Agarwal, Carroll, & Menachemi, 2018) and among previously ineligible non-elderly, childless, low-income adults (Courtemanche, Marton, Ukert, Yelowitz, & Zapata, 2017; Dworsky & Eibner, 2016; Lee & Porell, 2018), a group particularly vulnerable to homelessness (Byrne et al., 2013). Moreover, the effect of obtaining health insurance on improvements in health outcomes is similarly well described in the literature. Better health, in turn, enables increased participation in the work force and stable income (Hadley, 2003), which are protective factors against homelessness. In addition, given the strong relationship between housing needs and poor health, there has been growing interest in the use of Medicaid dollars to fund supportive housing services. Although Medicaid funds are prohibited by federal law from being used for room and board (Paradise & Ross, 2017), allowable benefits include a wide range of housing-related services for Medicaid enrollees at the discretion of state authorities.

Overview of the Dissertation

In sum, housing instability and homelessness are strong, independent risk factors for poor health status, inadequate access to primary care, and reliance on hospital-based care settings. However, the limitations inherent in population-level data about individuals and families who experience homelessness in the United States have hindered insights at

a national level, requiring creative uses of secondary data to examine associations between homelessness and the health care delivery system. Therefore, this dissertation seeks to contribute to further understanding of the relationship between homelessness and health care by drawing from largely untapped, nationally representative data resources.

This dissertation is composed of three studies that address research questions at the intersection of housing needs and the United States health care delivery system. The first study is a systematic review of the peer-reviewed literature evaluating interventions to reduce emergency department utilization among adults who experience homelessness. The second study uses national data to examine the impact of Medicaid expansion on rates of adult homelessness by comparing states that opted to expand their Medicaid eligibility requirements under the ACA with those that did not. Finally, the third study uses multiple years of national data to assess clinical quality performance among a subset of federally qualified health centers that received HCH funding to provide homeless-tailored primary care services.

CHAPTER 2: INTERVENTIONS TO REDUCE EMERGENCY DEPARTMENT UTILIZATION AMONG ADULTS EXPERIENCING HOMELESSNESS: A SYSTEMATIC REVIEW OF THE LITERATURE

Introduction

Homeless patients in developed countries bear a significant disease burden, including high rates of chronic conditions such as diabetes, asthma, and hypertension (Bernstein, Meurer, Plumb, & Jackson, 2015; Donley & Wright, 2018; Hwang, 2001); infectious diseases, including tuberculosis (Bamrah et al., 2013; Beijer et al., 2012; Powell et al., 2017; Sandgren et al., 2016), hepatitis C (Beijer et al., 2012; Cheung, Hanson, Maganti, Keefe, & Matsui, 2002; Desai, Rosenheck, & Agnello, 2003), and HIV/AIDS (Beijer et al., 2012; Khanijow et al., 2015; Noska, Belperio, Loomis, O'toole, & Backus, 2017), and serious mental illness and substance use disorders (Fazel et al., 2008; Lee et al., 2017; Nishio et al., 2015; Stringfellow et al., 2016; Tsai, Kaspro, & Rosenheck, 2014; Upshur, Jenkins, Weinreb, Gelberg, & Orvek, 2017). However, people who are homeless face significant barriers to accessing routine primary care services, which are intended to address a majority of personal health care needs (Donaldson et al., 1996). These barriers include lack of health insurance and unaffordability of out-of-pocket expenses (Chwastiak et al., 2012; Kertesz et al., 2014; Lebrun-Harris et al., 2013; Oates et al., 2009), inadequate transportation (Kertesz et al., 2014; McGuire et al., 2009), lack of knowledge about where to obtain primary care (Zur & Jones, 2014), and the presence of multiple competing needs that result in prioritizing food, clothing, and shelter over treatment of health concerns (Baggett et al., 2010; Gallagher et al., 1997; Gelberg et al., 1997; Zur & Jones, 2014). As a result, homeless individuals are likely to seek medical

treatment in emergency departments (Gelberg et al., 1997; Hall et al., 2012; Kangovi et al., 2013; Kushel et al., 2001; Lang et al., 1997; Mackelprang et al., 2015; Poulin et al., 2010), which in the United States are typically obligated to provide care regardless of patient ability to pay. Emergency department use is costly compared to outpatient health care services and, in many cases, can be avoided with timely, preventive primary care (Bharel et al., 2013; Kangovi et al., 2013; Kushel et al., 2002). Additionally, emergency departments are not intended to provide routine continuity care, and use of hospital-based emergency services as a usual source of health care is both inefficient and inappropriate in the context of existing health care delivery structures (Sandoval et al., 2010). However, compared to housed individuals, people who experience homelessness have a three-fold higher likelihood of using the emergency department (Kushel et al., 2002; Tadros et al., 2016).

A variety of interventions have shown promise in reducing use of emergency departments among adults who experience homelessness, typically by removing barriers to primary care access and addressing underlying health-related social needs that are common in this under-resourced population. Widely used community-based intervention models include permanent supportive housing, an evidence-based housing model that guarantees the provision of mental health and case management support services to chronically homeless individuals (DeSilva, Manworren, & Targonski, 2011; Parker, 2010; Wright, Vartanian, Li, Royal, & Matson, 2016); housing programs that feature onsite primary care services in addition to mental health and case management services (Wright et al., 2016); and assertive community treatment (ACT), a targeted case management approach for people living with mental illness that has been adapted for

homeless individuals (Lehman, Dixon, Kernan, DeForge, & Postrado, 1997). However, no existing reviews have examined the collective or relative effectiveness of these interventions or others in reducing emergency department use among homeless patients. One recent systematic review found that formerly homeless participants in permanent supportive housing programs had fewer emergency department visits compared to participants in a control condition (Baxter, Tweed, Katikireddi, & Thomson, 2019). Another review observed that use of a post-discharge medical respite program was associated with reduced hospital admissions among homeless patients, but did not evaluate emergency department outcomes or other types of interventions (Doran, Ragins, Gross, & Zerger, 2013). Other reviews have assessed the effect of interventions to improve access to primary care services among homeless populations, (Health Quality Ontario, 2016; White & Newman, 2015) but have not evaluated the effect of these interventions on emergency department use.

Therefore, the objective of the present study is to systematically review the research on interventions to reduce emergency department utilization among patients who are homeless. Given the complex health needs and costly health care utilization patterns of homeless individuals, it is important for payers as well as health care systems and social service providers to have evidence-based insight into the effectiveness of different intervention approaches (Cantor & Thorpe, 2018). In addition, the literature on homelessness and health care utilization spans many disciplines, including health services research, sociology, economics, and health behavior, making it difficult to readily assess the evidence base as a whole. Therefore, this review will integrate and evaluate the existing evidence and knowledge gaps in this area to provide actionable guidance for

policymakers and practitioners. To our knowledge, this is the most comprehensive review to date of interventions to reduce emergency department use among homeless patients. Previous reviews have focused only on housing interventions (Baxter et al., 2019), excluded observational and uncontrolled study designs (Baxter et al., 2019), and/or reported on interventions tested among emergency department “super-utilizer” populations, including but not limited to homeless patients (Iovan, Lantz, Allan, & Abir, 2019; Kumar & Klein, 2013). Since patients experiencing homelessness face unique challenges to using health care appropriately and effectively— challenges that may not be shared by other “super-utilizer” groups— this review seeks to provide guidance for effective intervention among the specific, high-need patient population of individuals who experience homelessness.

Methods

Reporting of this study adheres to the Preferred Reporting Items for Systematic Review and Meta-Analyses (PRISMA) recommendations for development and reporting on systematic reviews (Liberati et al., 2009). No human subjects or medical records were included as part of this study, so institutional review board approval was not required.

Search Strategy and Eligibility Criteria

A keyword search was conducted in November 2018 to identify relevant articles published in peer-reviewed journals indexed in the following health databases: MEDLINE, Embase, Web of Science Core Collection, PsycINFO, and the Cumulative Index to Nursing and Allied Health Literature (CINAHL). See Appendix A for full search

strategy. In addition, the reference lists of articles retrieved from database searching were manually reviewed to identify additional studies and search terms. Studies published in English-language, peer-reviewed journals (1980-2018) were considered for inclusion.

Using the Population, Intervention, Comparators, Outcomes, and Study Design (PICOS) framework (Higgins & Green, 2008), several criteria were established for inclusion of studies in this review. Articles that met the following inclusion criteria were considered: study participants were homeless or recently homeless adults (aged 18 years or older); the study evaluated the effects of an intervention, broadly construed to include services delivered across a variety of settings, including health care organizations, social services agencies, housing providers, and other community-based organizations; and the study reported on at least one outcome measure related to emergency department use. Studies that reported only health, psychosocial, housing, or other types of health care utilization (e.g., access to or use of primary care) outcomes were excluded. Non-empirical papers, clinical guidelines, and editorials were also excluded. No restrictions were imposed on comparison groups or study design.

Review Procedure

The article review process consisted of two rounds. First, the titles and abstracts of retrieved articles were screened to assess inclusion potential and eliminate duplicates. Screening was conducted by the first author and an additional graduate-level, trained reviewer. Studies not meeting inclusion criteria were excluded, with the primary reason for exclusion noted based on the pre-established PICOS criteria. Next, following a similar process, the full text articles of all studies included after title and abstract review were

screened for inclusion. The two reviewers debriefed to resolve and document any disagreements about inclusion or exclusion, with a third study team member available for arbitration. For each review round (title and abstract review and full text review), inter-reviewer reliability was assessed on a 10% random, overlapped subset of articles. Interrater agreement was high for both title and abstract review (Cohen's $\kappa = 0.89$) and full text review (Cohen's $\kappa = 0.93$). See Figure 2.1 for PRISMA study review flow diagram.

Data Extraction

After all full text articles had been reviewed and the final set of included studies were identified, reviewers began extracting data from included studies. Using a data extraction code sheet, two reviewers independently recorded information on key variables from each study. The data extraction code sheet was developed based on variables derived from the pre-established PICOS criteria that were related to characteristics of the study, intervention and control conditions, participant sample, and emergency department utilization outcomes.

Study-level characteristics extracted were study design, categorized according to the Cochrane Handbook for Systematic Reviews study design classifications (Higgins & Green, 2008), with definitions available in Appendix B; country; setting (urban, rural, multisite, or not reported); presence or absence of a comparison group; number of participants in each study arm and total number of participants; and study participant inclusion criteria (e.g., homeless adults with substance use disorder, adults experiencing chronic homelessness). Information about the intervention was extracted, including name or service model, description, and primary components, as well as information about the

control condition (where applicable). Characteristics of the participant sample extracted included mean or categorical distribution of age; gender composition (percent male, percent female, and percent unknown or other); racial composition (percent black or African-American, percent white, and percent other race); and ethnic composition (percent Hispanic or Latinx). Finally, data on study outcomes related to emergency department use were extracted, including unit of measurement, time points assessed, effect direction and magnitude, and statistical significance ($p \leq 0.05$) for each outcome.

In cases where two or more included articles were derived from the same study, project, or trial, data were synthesized from all relevant studies and only one article was selected for inclusion in the review to avoid introducing bias (Higgins & Green, 2008; Tramèr, Reynolds, Moore, & McQuay, 1997). The included article was selected based on comprehensiveness, recency, and article purpose; for example, a study reporting on the primary utilization outcomes of a given intervention would be chosen over a study reporting on cost-benefit analyses from the same intervention with the same study sample (see Appendix C for more details on selection rationale).

After data were extracted, formal meta-analysis (including between-study comparisons of effect sizes) was deemed inappropriate due to significant heterogeneity among included studies. Fewer than half of included articles (42.8%) reported emergency department utilization outcome data in a format that allowed for construction of a standardized measure (e.g., incidence rate ratio with 95% confidence intervals). An I^2 test was used to assess the potential impact of between-study heterogeneity on meta-analysis results by quantifying the percentage of variability in effect estimates due to heterogeneity, with an I^2 value of $\geq 50\%$ indicating substantial to considerable

heterogeneity (Higgins, Thompson, Deeks, & Altman, 2003). Among included studies, the I^2 was 97%, indicating significant heterogeneity. Therefore, a systematic review was conducted without meta-analysis. Associations between study and intervention characteristics were statistically tested using χ^2 or Fisher's exact tests where appropriate.

Assessment of Study Risk of Bias

It is important to assess the internal validity of individual studies included in systematic reviews to account for bias arising from sources such as selection bias, confounding, and inferential error (Lohr, 2004). Given the heterogeneity of study designs and paucity of experimental designs among articles included in this study, study design was used as a proxy measure for risk of bias in this review. During the data extraction process, the design of each included study was categorized based on the Cochrane Handbook for Systematic Reviews study design classifications (Higgins & Green, 2008). Studies were then assigned a risk of bias rating based on their design. Included studies consisting of a randomized controlled trial or a non-randomized controlled trial were rated "low risk of bias." Conversely, included studies consisting of a controlled before-and-after comparison, a cohort study, or a before-and-after comparison were rated "high risk of bias" (see Appendix B for details of study design classification and risk of bias rating).

Results

Search Results

The initial search yielded 2,989 records, with 1,752 records remaining after duplicates were removed. After title and abstract screening, 352 full-text articles were assessed, from which 42 articles were selected for final review inclusion (see Figure 2.1 for study selection flowchart). After excluding articles reporting on results from the same study (see Appendix C), the final sample included 35 studies.

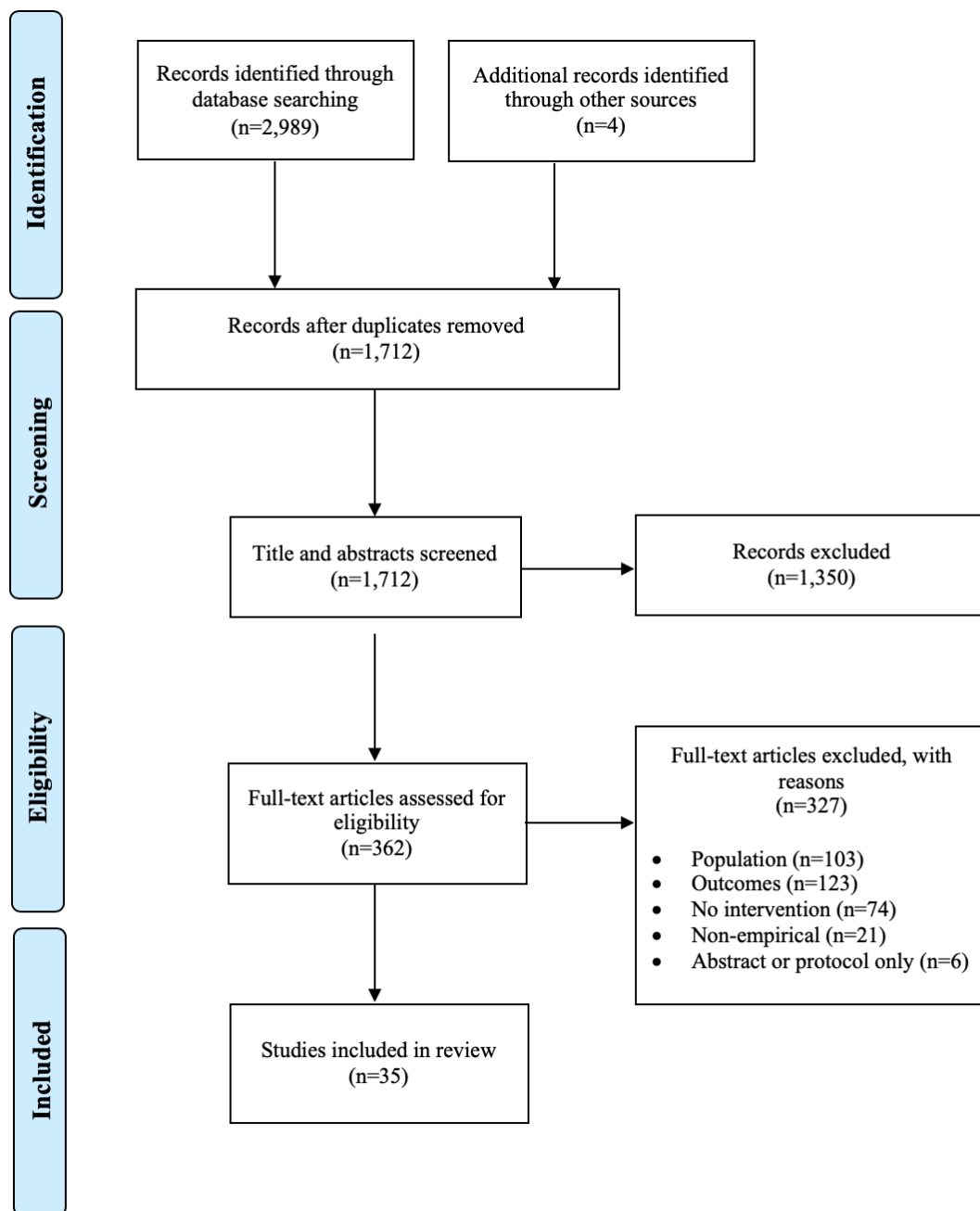


Figure 2.1. Preferred Reporting Items for Systematic Review and Meta-Analyses (PRISMA) flow diagram for study selection

Study Characteristics

Of the 35 studies included in this review, 8 studies (22.9%) were randomized controlled trials (RCTs); 3 studies (8.6%) were non-randomized controlled trials (NRCTs); 4 studies (11.4%) were cohort studies; 10 studies (28.6%) were controlled

before-and-after studies; and 10 studies (28.6%) consisted of before-and-after comparisons (no control group). The majority of studies ($n = 26$; 74.3%) were conducted in the United States, with other studies set in Canada ($n = 5$), Australia ($n = 3$), and the United Kingdom ($n = 1$). The median study sample size (including controls, where applicable) was 168 participants, who were on average 45.8 years old (± 5.1 years; 28 studies reporting). Participant samples were, on average, largely male (mean: 78.3% \pm 14.9%; 31 studies reporting) and white (mean: 49.8% \pm 22.7%, 22 studies reporting) or black (mean: 41.6% \pm 21.3%; 16 studies reporting). See Tables 2.1 and 2.2 below for descriptive characteristics for the sample of included studies (Table 2.1) and for each included study individually (Table 2.2).

Table 2.1. Characteristics of included studies and interventions (n = 35 studies)

	n	%
Intervention Type		
Permanent supportive housing	14	40.0
Case management	9	25.7
Community setting	6	17.1
Clinical setting	4	11.4
Respite care	1	2.9
Transitional housing	1	2.9
Study Design		
Controlled before-and-after study	10	28.6
Before-and-after comparison	10	28.6
Randomized controlled trial	8	22.9
Cohort study	4	11.4
Non-randomized controlled trial	3	8.6
Study Risk of Bias		
High	24	68.6
Low	11	31.4
Intervention Country		
United States	26	74.3
Canada	5	14.3
Australia	3	8.6
United Kingdom	1	2.9
Intervention Setting		
Urban	30	85.7
Rural	1	2.9
Multisite or not reported	4	11.4
Special Population or Health Condition^a		
Chronically homeless	11	31.4
Serious mental illness	8	22.9
Veterans	7	20.0
Substance use disorder ^b	6	17.1
HIV	3	8.6
Chronic disease	3	8.6

NOTES ^aCategories are not mutually exclusive. ^bIncludes alcoholism.

Table 2.2. Overview and characteristics of included studies (n = 35 studies)

First Author and Year	Country	Sample	Special Population or Health Condition	Intervention	Control	Follow- up (Months)	Study Design
Aubry 2016	CAN	Treatment: 469 Control: 481	Serious mental illness	At Home/Chez Soi multisite Housing First permanent supportive housing with assertive community treatment	Treatment as usual	18	RCT
Buchanan 2006	USA	Treatment: 161 Control: 64	General adult homeless	Post-hospital discharge respite care with interim housing, health care, case management, and referral to permanent housing	Waitlist	12	CS
Ciaranello 2006	USA	Treatment: 202 Control: 50	General adult homeless	Health care demonstration project at transitional housing facilities	Residents of non- intervention facilities	18	CBA
DeSilva 2011	USA	Treatment: 18 Control: N/A	Chronic homelessness	Housing First permanent supportive housing program	N/A	24	BAC

First Author and Year	Country	Sample	Special Population or Health Condition	Intervention	Control	Follow- up (Months)	Study Design
Dobbins 2016	USA	Treatment: 78 Control: 73	HIV	Direct Access to Housing (DAH) Housing First permanent supportive housing with onsite nursing care	Housing without onsite nursing care	12	CBA
Driscoll 2018	USA	Treatment: 87 Control: N/A	Chronic homelessness	Housing First permanent supportive housing	N/A	18	BAC
Dunford 2006	USA	Treatment: 156 Control: 373	Alcoholism	Outpatient jail diversion alcohol treatment program	Jail time with no alcohol treatment program	24	CBA
Gundlapalli 2017	USA	Treatment: 3981 Control 1: 24363 Control 2: 23542	Veterans	Homeless Patient-centered Care Team (H-PACT) tailored patient-centered medical home model	Usual care at 1) non- intervention clinics and 2) intervention clinics	6	CBA

First Author and Year	Country	Sample	Special Population or Health Condition	Intervention	Control	Follow- up (Months)	Study Design
Hewett 2016	UK	Treatment: 206 Control: 204	General adult homeless	In-hospital care management and discharge planning	Treatment as usual	12	RCT
Kessell 2006	USA	Treatment: 114 Control: 135	General adult homeless	Housing First permanent supportive housing	Waitlist	24	CS
Kushel 2006	USA	Treatment: 280 Control: N/A	HIV	Use of any case management services	N/A	15	BAC
Lehman 1999	USA	Treatment: 77 Control: 75	Serious mental illness	Assertive community treatment	Treatment as usual	12	RCT
Malte 2017	USA	Treatment: 91 Control: 90	Veterans	Addiction and housing case management with emphasis on life skills training	Housing support group with no case management	12	RCT

First Author and Year	Country	Sample	Special Population or Health Condition	Intervention	Control	Follow- up (Months)	Study Design
Martinez 2006	USA	Treatment: 236 Control: N/A	Mental illness and substance use disorder	Permanent supportive housing	N/A	12	BAC
McCormack 2013	USA	Treatment: 20 Control: 40	Chronic homelessness; Alcoholism	Hospital-based case management and homeless outreach services	Treatment as usual	6	NRCT
McGuire 2009	USA	Treatment: 130 Control: 130	Mental illness or substance use disorder; Veterans	VA demonstration clinic integrating homeless, primary care, and mental health services	Treatment as usual	18	CBA
McInnes 2014	USA	Treatment: 21 Control: N/A	Veterans	Brief text message reminders for primary care visits at VA homeless primary care clinic	N/A	2	BAC
Montgomery 2013	USA	Treatment: 107 Control: 70	Chronic homelessness; Veterans	Housing First permanent supportive housing and assertive community treatment	Treatment as usual	12	CBA

First Author and Year	Country	Sample	Special Population or Health Condition	Intervention	Control	Follow- up (Months)	Study Design
Moore 2017	USA	Treatment: 274 Control: 116	Chronic homelessness	Multisite permanent supportive housing demonstration	Treatment as usual	12	CBA
Parker 2010	USA	Treatment: 20 Control: N/A	Chronic homelessness	Housing First permanent supportive housing	N/A	6	BAC
Parsell 2017	AUS	Treatment: 41 Control: N/A	Chronic homelessness	Housing First permanent supportive housing	N/A	12	BAC
Podymow 2006	CAN	Treatment: 17 Control: N/A	Chronic homelessness; Alcoholism	Managed alcohol harm reduction program with housing	N/A	24	BAC
Redelmeier 1995	CAN	Treatment: 65 Control: 68	General adult homeless	Emergency department-based “compassionate care” from volunteers	Treatment as usual	6.5	RCT

First Author and Year	Country	Sample	Special Population or Health Condition	Intervention	Control	Follow- up (Months)	Study Design
Rieke 2015	USA	Treatment: 23 Control: N/A	Chronic medical or mental illness	Participation in any supportive housing or housing with support services across metro area	N/A	12	BAC
Rothbard 2004	USA	Treatment: 146 Control: N/A	Serious mental illness	Assertive community treatment demonstration project	N/A	12	BAC
Sadowski 2009	USA	Treatment: 201 Control: 204	Chronic illness	Post-hospital discharge transitional housing placement with onsite case management	Treatment as usual	18	RCT
Siskind 2013	AUS	Treatment: 113 Control: 139	Serious mental illness	Transitional housing team services with support for independent living skills, relapse prevention, crisis management, and linkage to community services	Treatment as usual	12	CBA

First Author and Year	Country	Sample	Special Population or Health Condition	Intervention	Control	Follow- up (Months)	Study Design
Smelson 2018	USA	Treatment: 81 Control: 87	Veterans	MISSION-Vet treatment program for co-occurring mental health and substance abuse	Enrolled in intervention at sites without implementation strategy	12	CBA
Srebnik 2013	USA	Treatment: 29 Control: 31	Chronic homelessness; chronic illness	Begin at Home (BAH) Housing First permanent supportive housing	Treatment as usual	12	CBA
Stergiopoulos 2015	CAN	Treatment: 70 Control: 70	Serious mental illness	Integrated multidisciplinary shelter-based collaborative care	Collaborative care provided offsite (not shelter-based)	12	NRCT
Vallance 2016	CAN	Treatment: 13 Control: 10	Chronic homelessness; alcoholism	Managed alcohol harm reduction program with housing	Waitlist	12	CBA
Whittaker 2017	AUS	Treatment: 26 Control: 37	Chronic homelessness	Housing First permanent supportive housing (single-site)	Scatter-site housing placement	12	NRCT

First Author and Year	Country	Sample	Special Population or Health Condition	Intervention	Control	Follow-up (Months)	Study Design
Wolitski 2009	USA	Treatment: 315 Control: 315	HIV	Housing Opportunities for People with AIDS (HOPWA) rental assistance program with case management	Usual housing placement services without rental assistance	18	RCT
Wright 2016	USA	Treatment: 98 Control: N/A	General adult homeless	Housing First permanent supportive housing	N/A	12	BAC
Yoon 2017	USA	Treatment: 195 Control: 180	Veterans	Peer mentorship program	Treatment as usual	6	RCT

NOTES Abbreviations: BAC=Before-and-after comparison; CS=Cohort study; CBA=Controlled before-and-after study; NRCT=Non-randomized controlled trial; RCT=Randomized controlled trial. ^aWhittaker (2017) compared a single-site Housing First program with a scatter-site program (treated as the control group because the Housing First model was originally developed for use in scatter-site arrangement).

Intervention Characteristics and Effects

By design, all studies reported on at least one outcome related to emergency department utilization, measured as mean number of visits, total number of visits across the sample (e.g., a treatment group of 46 participants reported 112 total emergency department visits during the study period), and proportion of participants using the emergency department one or more times during the study period. The average length of study follow-up for assessment of emergency department outcomes was 13.5 months (\pm 5.7 months). Overall, studies either reported a positive intervention effect on emergency department use ($n = 18$; 51.4%), indicating reductions in use, or no effect of the intervention on emergency department use ($n = 17$; 48.6%). Across all interventions, 36.4% of studies with a low risk of bias reported a positive effect, compared to 58.3% of studies with a high risk of bias; however, this difference was not statistically significant ($\chi^2 = 1.46$; $p = 0.227$).

Included studies were comprised of multiple different types of interventions. Due to the large and heterogeneous mix of interventions, individual studies were grouped into the following larger, mutually exclusive categories: permanent supportive housing interventions ($n = 14$; 40.0%); case management interventions ($n = 9$; 25.7%); community-based interventions, defined as interventions taking place in non-clinical, community settings such as shelters or homeless drop-in centers and for which the primary focus was not permanent supportive housing or case management ($n = 6$; 17.1%); clinical interventions, defined as interventions taking place in hospitals, outpatient clinics, or other health care facilities for which the primary focus was not permanent supportive housing or case management ($n = 4$; 11.4%); and other

interventions (n = 2; 5.8%). Other interventions included a transitional housing program (n = 1) and a respite care intervention (n = 1). Although some interventions have overlapping features (e.g., a permanent supportive housing program with a case management component), the intervention was classified based on the primary focus as stated by study authors. See Table 2.3 for more details about each intervention type and descriptions of specific interventions in these categories.

Table 2.3. Description of intervention categories

Intervention Category	Description
Permanent supportive housing	<ul style="list-style-type: none"> – Combines affordable housing, health care, and supportive services (e.g., on-site social work staff). – Intended for people who experience multiple barriers to housing and are unable to maintain housing stability without supportive services (US Interagency Council on Homelessness, 2018).
Housing First	<ul style="list-style-type: none"> – A model of permanent supportive housing based on harm reduction principles that emphasizes consumer choice. – Housing provided without sobriety or treatment participation requirements (Tsemberis, Gulcur, & Nakae, 2004).
Case management	<ul style="list-style-type: none"> – Process in which an individual case manager or team coordinates multiple aspects of a client’s health care and social service use (Hickam et al., 2013). – Basic functions include outreach, assessment, planning, linkage, monitoring, and advocacy (Morse, 1999). – Services often include practical support, acute care in crisis situations, and support with medical, psychiatric, and substance abuse treatment (de Vet et al., 2013; Vanderplasschen, Rapp, Wolf, & Broekaert, 2004).
Community-based	<ul style="list-style-type: none"> – Any interventions taking place in non-clinical, community settings (e.g., shelters, homeless drop-in centers, jails, etc.) for which the primary focus is not case management or permanent supportive housing.
Clinical	<ul style="list-style-type: none"> – Any interventions taking place in hospitals, emergency departments, outpatient clinics, or other health care facilities for which the primary focus is not case management or permanent supportive housing.

Transitional housing	<ul style="list-style-type: none"> – Temporary, time-limited (24 months or less) supportive housing intended to bridge the gap from homelessness and emergency shelter use to permanent housing (Burt, 2006). – Services can include treatment support, life skills training, and vocational skills.
Respite care	<ul style="list-style-type: none"> – Programs to providing transitional care and shelter for homeless patients to recuperate upon hospital discharge (Doran, Ragins, Gross, et al., 2013).

Permanent Supportive Housing

Fourteen studies described a permanent supportive housing intervention (Aubry, Nelson, & Tsemberis, 2015; DeSilva et al., 2011; Dobbins et al., 2016; Driscoll et al., 2018; Kessell et al., 2006; Martinez & Burt, 2006; Montgomery, Hill, Kane, & Culhane, 2013; Moore & Rosenheck, 2017; Parker, 2010; Parsell, Petersen, & Culhane, 2016; Rieke et al., 2015; Srebnik, Connor, & Sylla, 2013; Whittaker, Dobbins, Swift, Flatau, & Burns, 2017; Wright et al., 2016), the majority of which (n=11) were based on the Housing First model (Aubry et al., 2015; DeSilva et al., 2011; Dobbins et al., 2016; Kessell et al., 2006; Montgomery et al., 2013; Parker, 2010; Srebnik et al., 2013; Whittaker et al., 2017; Wright et al., 2016). Housing First is an evidence-based approach to permanent supportive housing in which homeless individuals are housed in a supportive environment without requirements for sobriety and social services or case management participation (see Table 2.3)(Tsemberis et al., 2004) Two permanent supportive housing studies reported on the addition of assertive community treatment to a Housing First program (Aubry et al., 2015; Montgomery et al., 2013). The remaining three permanent supportive housing studies either described programs similar to a

Housing First approach (i.e., low or no treatment demands) without explicitly calling it such (Martinez & Burt, 2006) or reported on the congregate effects of enrollment among study participants in one of multiple different housing programs, some of which followed a Housing First approach and some of which did not (Moore, 2012; Rieke et al., 2015)

Positive effects on (i.e., reductions in) emergency department use were reported by half of all permanent supportive housing interventions ($n = 7$). All seven studies reporting a positive effect associated with permanent supportive housing were rated as having a high risk of bias. In addition, permanent supportive housing studies with a high risk of bias were more likely to report a positive effect on emergency department use (58.3%) than studies with a low risk of bias (0.0%; $p = 0.462$). Permanent supportive housing interventions that utilized a Housing First approach were less likely to report a positive effect on emergency department use (36.4%) than interventions not following the Housing First model (100.0%; $\chi^2 = 3.82$; $p = 0.096$).

Case Management

Multiple studies ($n = 9$; 25.7%) evaluated the impact of case management interventions on emergency department use among homeless clients. Two studies specifically described the effects of traditional assertive community treatment interventions adapted for use among clients experiencing homelessness (Lehman et al., 1997; Rothbard, Min, Kuno, & Wong, 2004), while another study broadly evaluated the use of any community case management services (Kushel, Colfax, et al., 2006). Several studies focused on the effects of case management services in particular settings or for specific health concerns. Specifically, two interventions involved in-hospital case

management and discharge planning services for hospitalized homeless patients (Hewett et al., 2016; McCormack, Hoffman, Wall, & Goldfrank, 2013) while one study reported on a post-discharge case management program focused on immediate housing placement services (Sadowski, Kee, VanderWeele, & Buchanan, 2009). Two studies described Veterans Health Administration (VHA)-based case management programs for homeless veterans diagnosed with substance use disorder (Malte, Cox, & Saxon, 2017; Smelson, Chinman, Hannah, Byrne, & McCarthy, 2018). Finally, one study reported on the effect of case management in addition to rental assistance subsidies through the national Housing Opportunities for Persons with AIDS (HOPWA) program, co-administered by the US Department of Housing and Urban Development (HUD) and the Centers for Disease Control and Prevention (CDC) (Wolitski et al., 2010).

Overall, a minority of studies evaluating case management interventions ($n = 3$; 33.3%) reported a positive effect of the intervention on emergency department use. Intervention approaches that were associated with reduced emergency department use included use of on-call social workers and homeless outreach teams to coordinate care and services upon presentation of homeless patients to the emergency department (McCormack et al., 2013), and case management services from an in-hospital social worker, including plans for discharge to a respite care facility for transitional care between hospitalization and stable housing (Sadowski et al., 2009). The effects of assertive community treatment interventions were mixed, as one earlier study reported reductions in emergency department use (Lehman et al., 1997) while another, more recent study reported no effect of the assertive community treatment intervention on emergency department use among homeless clients (Rothbard et al., 2004). When tested

statistically using a Fisher's exact test, case management interventions with a low risk of bias were more likely to report a positive intervention effect on emergency department use (33.3%) than studies with a high risk of bias (0.0%; $p = 0.238$).

Community-based Interventions

Several studies ($n = 6$) evaluated other types of interventions (i.e., not classifiable as permanent supportive housing or case management interventions) that took place in a community setting outside of a hospital or health care facility. Three of these studies evaluated the provision of outpatient primary care services at homeless-specific community service sites, including a shelter (Stergiopoulos et al., 2015), a homeless drop-in center (McGuire et al., 2009), and a transitional housing facility (Ciaranello et al., 2006). Two studies evaluated managed alcohol programs, in which homeless individuals received treatment for alcohol abuse issues using a harm reduction approach (Vallance et al., 2016) (Podymow, Turnbull, Coyle, Yetisir, & Wells, 2006), while another examined the effects of a municipal outpatient jail diversion and alcohol treatment program on reducing emergency services use (Dunford et al., 2006).

Two-thirds ($n = 4$) of all community-based interventions reported a positive effect on emergency department use associated with the intervention, while the remaining one-third ($n = 2$) found no effect on emergency department use. Specifically, interventions that consisted of onsite health care services at transitional housing facilities (Ciaranello et al., 2006) or at a homeless drop-in center (McGuire et al., 2009) and an outpatient jail diversion and alcohol rehabilitation program (Dunford et al., 2006) were associated with reductions in emergency department use among homeless participants. The two managed

alcohol programs, both conducted in Canada, drew contradictory conclusions, with one study reporting a positive effect (Podymow et al., 2006) and the other reporting no effect (Vallance et al., 2016) of the managed alcohol program on emergency department use among homeless participants. In Fisher's exact tests, studies of community-based interventions with a low risk of bias were less likely to report a positive effect on emergency department use (0.0%) compared with high risk of bias studies (80.0%), but this difference did not reach statistical significance ($p = 0.333$).

Clinical Interventions

Four studies examined interventions that took place in hospitals, outpatient clinics, or other health care settings (Gundlapalli et al., 2017; McInnes et al., 2014; Redelmeier, Molin, & Tibshirani, 1995; Yoon, Lo, Gehlert, Johnson, & O'Toole, 2017). One study evaluated an emergency department-based "compassionate care" trial in which volunteers brought hot food to and engaged in conversation with admitted homeless patients (Redelmeier et al., 1995), while another examined the use of primary care-based peer mentors at VA outpatient clinics (Yoon et al., 2017). The largest study in this review (sample size: 51,886 participants) evaluated the effect of a homeless-tailored patient-centered medical home model in VA outpatient clinics (Gundlapalli et al., 2017). Finally, another VA-based study examined the use of text message appointment reminders among homeless veterans receiving care at outpatient VA primary care clinics (McInnes et al., 2014).

Text message appointment reminders (McInnes et al., 2014), the use of primary care services within a homeless-tailored patient-centered medical home (Gundlapalli et

al., 2017), and compassionate care from emergency department-based volunteers (Redelmeier et al., 1995) were all associated with a positive effect on emergency department use. The use of primary care-based peer mentors among homeless veterans was not associated with any effect on emergency department use (Yoon et al., 2017). In Fisher's exact tests, studies of clinical interventions with a low risk of bias were less likely to report a positive effect on emergency department use (50.0%) compared with studies rated as having a high risk of bias (100.0%; $p = 0.500$).

Other Interventions

One study evaluated a transitional housing program providing supportive services for homeless adults with serious and persistent mental illness (Siskind et al., 2014), finding no effect of the intervention on emergency department use among participants. Another study examined the use of a respite care program for homeless patients discharged from the hospital that provided interim housing, on-site health care, case management, and referrals to permanent housing (Buchanan, Doblin, Sai, & Garcia, 2006). Respite care in this study was associated with a statistically significant decrease in the number of subsequent emergency department visits (Buchanan et al., 2006). Both studies featured study designs with a high risk of bias.

Discussion

Excessive and inappropriate use of the emergency department is common among patients who are homeless and is a potentially modifiable driver of health care costs for patients and health systems (Kumar & Klein, 2013). Since individual assessments of

interventions tested among homeless populations are often small and lacking in generalizability (i.e., limited to a single hospital, clinic, or shelter), the present systematic review adds value by collating the literature on this topic, potentially increasing the generalizability of findings to an extent not possible with results from individual studies alone. However, in this review, there was limited evidence suggesting that existing housing, case management, community-based, or clinical interventions for homeless patients have a significant effect on reducing emergency department use.

First, only half of the 35 interventions in this review demonstrated a positive effect on emergency department use (i.e., a reduction in use) among homeless patients. While fifty-percent effectiveness among included interventions may, optimistically, be interpreted as a positive finding, it is difficult to draw meaningful conclusions given the limitations of the underlying evidence base. Overall, nearly 70% of included studies were rated as having a high risk of bias based on their study designs. Without studies strong in internal validity, it is difficult to establish causality in the relationship between any given intervention and emergency department use.

In this review, no single intervention type demonstrated clear superiority over others in reducing emergency department use among homeless participants. When comparing the broader intervention categories, studies classified as clinical interventions had the highest proportion of studies reporting a positive effect (75%). However, the number of included studies in this category was small ($n = 4$) and quite heterogeneous, limiting the utility of this finding. The case management category had the lowest proportion of interventions reporting a positive effect (33%, or 3 of 9 studies), but also consisted of a wide variety of intervention types, making it difficult to draw conclusions

from this evidence base. Permanent supportive housing interventions, which share many common features and arguably comprise the most homogenous category of those assessed in this study, failed to demonstrate a clear direction of effect, with just half of studies reporting positive effects on emergency department use associated with the intervention.

In addition, the boundaries between different intervention categories are vague and overlap in many cases; for example, permanent supportive housing interventions typically feature some level of case management services. Although interventions were categorized into mutually exclusive categories based on the primary focus and activities of the intervention, this overlap makes it difficult to connect outcomes within this body of work to any one intervention type. Related to this, overlap between different intervention types and the comprehensive array of services and supports offered as part of many interventions makes it difficult to isolate the relationship between specific intervention components and emergency department use outcomes.

As a whole, the findings from this systematic review indicate a need for more large-scale studies with strong internal validity. Several individual studies included in this review demonstrate the possibility of multisite, randomized trials, even among a population that is historically difficult to study. For example, the At Home/Chez Soi multisite permanent supportive housing program in Canada is the largest randomized trial to date on the Housing First model, encompassing five cities and following more than 2,000 formerly homeless participants over two years (Aubry et al., 2015). In the United States, VA studies with large sample sizes and nationally representative data demonstrate that large scale studies can effectively be done to study homelessness and follow

homeless patients over time as they connect with health care and supportive services (Gundlapalli et al., 2017).

One notable gap in this body of research is the lack of quasi-experimental designs or natural experiments, which overcome many of the ethical and pragmatic hurdles imposed by traditional experimental designs without sacrificing internal validity. Quasi-experimental studies use design features to establish causality by ruling out many plausible alternative explanations for an association, even based on individuals who are not randomly assigned to conditions (Cook, Campbell, & Shadish, 2002). For example, quasi-experimental approaches have been critical in our understanding of policy and program impacts related to public health concerns like suicide prevention,^{89,90} smoking bans,^{91,92} and sugar-sweetened beverage taxes (Zhong, Auchincloss, Lee, & Kanter, 2018). In the specific domain of homelessness, the application of quasi-experimental designs has been used to establish causal relationships between emergency financial assistance and avoiding homelessness (Evans, Sullivan, & Wallskog, 2016). Future research in the area of homelessness and health care utilization might explore the use of quasi-experimental designs to enhance the rigor of the research base and contribute stronger causal evidence for policymakers and health systems administrators. For example, a policy or economic shock that creates an exogenous source of variation in factors affecting homeless populations could create an opportunity for research that is strong in internal validity.

Other methodological concerns populate the body of research included in this review. First, regression to the mean is a serious concern in interventional studies among this population, given that many homeless patients may become enrolled in a given

intervention during a time of peak acute care services utilization associated with crisis. Regardless of any intervention, one would expect to see utilization decrease back to mean or baseline levels over time. For example, several studies included in this review observed similar trends in decreasing emergency department use for both treatment and control groups. Again, issues posed by regression to the mean can be mitigated through more rigorous study design features, including random allocation and use of repeated measures (Barnett, Van Der Pols, & Dobson, 2004). Another limitation of studies in this review relates to nuances in measuring emergency department use. Only two included studies made a distinction between any emergency department use and potentially preventable emergency department use. Since the goal of interventions to help the homeless is, at least nominally, to facilitate appropriate emergency department use and not prevent use of emergency services when a genuine emergency occurs, this represents a limitation in our ability to understand patterns of use and intervention effects. In addition, clinical criteria that constitute an avoidable emergency department visit for a member of the general population may be very different from those appropriate for a person experiencing homelessness. For example, in extreme weather conditions (e.g., dangerously cold or hot) and in the absence of other modes of shelter, homeless patients may be facing an emergency situation that warrants seeking treatment in the emergency department. More research is needed to explore the application of appropriate measures of utilization for homeless patients, given the unique needs and adaptation strategies of people who experience homelessness.

In addition, this review demonstrates the limited generalizability of research in this area to a range of populations and settings. The vast majority of participants in

included studies were men. However, homelessness among women is a serious and widespread concern (D'Ercole & Struening, 1990; Wenzel, Koegel, & Gelberg, 2000), with women comprising nearly 40% of the US homeless population (Henry et al., 2017) , yet there is a dearth of research around gender differences in emergency department utilization. Similarly, only one of the 35 studies included in this review evaluated an intervention taking place in a rural setting (Driscoll et al., 2018). This finding is logical given that the majority of people in Western nations who experience homelessness live in cities, where social services and transportation tend to be clustered and more readily accessible to people of limited resources. However, the US Department of Housing and Urban Development (HUD) estimates that 15% of the total homeless population in the United States live in rural areas . In addition, people who experience housing instability in rural or suburban areas have been called the “hidden homeless” because they are more likely to stay in hotels or motels or “double up” with family members than stay in shelters or on the streets, and therefore are much harder to identify and intervene upon (Cloke, Widdowfield, & Milbourne, 2000; Kannegaard & Pizano, 2019). Any estimates of rural homelessness are likely an undercount of the true extent of the housing problem, and one recent analysis estimated an 11-percent growth in rural homelessness among grade-school children in the United States (Kannegaard & Pizano, 2019). Thus, further research is needed to explore interventions among people who experience homelessness in non-urban settings.

There are limitations to this systematic review. First, studies from the grey (i.e., non-peer-reviewed) literature were not included due to feasibility constraints, creating the potential for publication bias. Health systems and non-profit organizations that

implement and formally evaluate interventions to reduce emergency department use among homeless patients may have white papers or program evaluation reports that contain valuable insights for this research question. Second, as previously discussed, formal meta-analysis was not possible due to heterogeneity among included studies. However, even in the absence of meta-analytic techniques, this review contributes new insights into the scope and quality of the existing published evidence on the effectiveness of interventions to reduce emergency department use among homeless patients.

CHAPTER 3: THE IMPACT OF MEDICAID EXPANSION ON RATES OF HOMELESSNESS

Introduction

Housing instability, including struggles to pay rent or utilities, frequent moves, or overcrowded conditions, is a significant public health concern in the United States, affecting an estimated one-quarter of American households (Desmond, 2012; Frederick et al., 2014; Gilman et al., 2003; Kushel, Gupta, et al., 2006; Phinney et al., 2007). Housing instability often precedes literal homelessness,⁶⁻⁸ and most people who are homeless have previously experienced one or more periods of housing instability (Reid et al., 2008; Sosin, 2003). Both housing instability and homelessness have been consistently associated with poor health outcomes (Burgard, Seefeldt, & Zelner, 2012; Kushel, Gupta, et al., 2006; Kushel et al., 2002). In turn, the physical, emotional, and financial costs of poor health contribute to unemployment and financial catastrophe, which are strong antecedents of housing instability and subsequent homelessness (Elliott & Krivo, 1991). Specifically, the costs associated with sudden adverse health events can directly precipitate homelessness among individuals who are already housing unstable (Babiarz, Widdows, & Yilmazer, 2013; Curtis et al., 2013). However, health insurance coverage may be protective against health-related financial shocks and, potentially, homelessness (Finkelstein et al., 2012).

With the passage of the Affordable Care Act (ACA) in 2010, the widespread expansion of Medicaid eligibility requirements to low-income adults in many states provides new insurance options for previously ineligible, vulnerable populations, including many adults experiencing housing instability or homelessness (Baird, 2016;

Carlson et al., 2006). A small body of previous work has established the impact of gaining health insurance on reduced financial burden among individuals in need of health care services (Finkelstein et al., 2012; Hadley, 2003). One recent analysis found that obtaining health insurance through ACA Marketplace subsidies resulted in a 26% drop in the rate of home delinquency, suggesting that newly insured low-income households were protected from falling behind on rent or mortgage payments (Gallagher, Gopalan, & Grinstein-Weiss, 2018). Similarly, additional evidence has demonstrated that Medicaid expansion was associated with a lower number of payday loans and reduced loan debt among enrollees in California (Allen, Swanson, Wang, & Gross, 2017). While a growing body of work has demonstrated the effect of Medicaid expansion on rates of insurance coverage, access to health care, and improvements in some quality measures among enrollees in states that chose to expand eligibility (Lee & Porell, 2018; Mazurenko et al., 2018), no studies have examined the potential impact of Medicaid expansion on homelessness.

Therefore, the purpose of this study is to examine the impact of Medicaid expansion on state-level homelessness rates by comparing states that did and did not expand Medicaid eligibility requirements under the ACA. To the extent that health insurance is protective against large or unexpected medical expenditures, it may be expected that low-income, housing unstable individuals gaining insurance under Medicaid expansion would be better protected against medical bankruptcy and subsequent homelessness. Conversely, in states that did not opt to expand Medicaid, low-income, housing unstable adults will not have gained additional protection against health-related financial shocks, remaining more vulnerable to homelessness. In addition, certain

subgroups of homeless adults, including those living as part of a family with children, those living as single individuals, veterans, and individuals who have experienced chronic homelessness, may be differentially susceptible to changes in access to public health insurance. Specifically, since non-elderly, low-income adults historically have not been eligible for Medicaid coverage in many states, it was anticipated that individuals (both single and living in families with children) would demonstrate the most pronounced gains as a result of Medicaid expansion under the ACA. Conversely, most veterans qualify for health insurance coverage under the US Department of Veterans Affairs, and chronically homeless adults were already Medicaid-eligible under pre-ACA eligibility requirements because of a qualifying disability. Therefore, no significant changes in rates of homelessness among veterans or the chronically homeless in expansion states were expected, and these subgroups were included as robustness checks against the main findings of this study.

Methods

The impact of Medicaid expansion on rates of homelessness at the state level was evaluated using two-way fixed effects analyses of eight years (2010-2017) of state-level panel data to compare changes in homelessness rates for states that implemented Medicaid expansion compared to those that did not implement Medicaid expansion during this time period. In addition to rates of overall homelessness, the impact of Medicaid expansion on the following homeless sub-groups was examined: single adult individuals, adult individuals in families with children, veterans, and individuals who experience chronic homelessness.

Dependent Variables

For the outcome measures of interest, national homelessness count data from the US Department of Housing and Urban Development (HUD) were used. These data are the sole national census of homelessness in the United States and are used to inform legislative decision-making related to funding allocation, service delivery strategies, and to track trends in the extent and types of homelessness across states over time (Byrne et al., 2013; Stanley, 2017). Data on homelessness are collected annually within predetermined service areas by Continuum of Care (CoC) organizations, which are regional or local planning bodies funded by HUD to coordinate housing and services for homeless families and individuals.²⁶ Homelessness counts are reported annually by CoCs to HUD based on data from two sources: single-night, point-in-time counts of both sheltered and unsheltered homeless populations, as well as counts of the sheltered homeless population over a full year provided by a sample of communities based on data in their Homelessness Management Information Systems (HMIS). For outcome measures of interest, state population estimates from the US Census Bureau, American Community Survey were used to construct a measure for homelessness per 10,000 state residents in a given year.

In addition to annual overall homelessness counts, HUD provides counts for several, non-mutually exclusive homeless sub-groups, available as a total count and by sheltered and unsheltered status, including: individuals, individuals in families with children, veterans, and individuals who experience chronic homelessness. “Individuals” refer to adults who are not part of a family with children during an episode of

homelessness, while “individuals in families” are defined as adults who are homeless as part of a household that has at least one child under the age of 18 years. “Veteran” denotes any person experiencing homelessness who served on active duty in the armed forces of the United States, including Reserves and National Guard members who were called up to active duty. Finally, “chronically homeless” is a designation given by the US government to individuals with a qualifying disability who have been continuously homeless for one year or more or have experienced at least four episodes of homelessness in the last three years.

HUD additionally classifies homeless subgroups based on current living arrangement as “sheltered” (includes staying in emergency shelters, transitional housing programs, or safe haven sites, or doubled up with family or friends) or “unsheltered” (includes maintaining a primary nighttime residence in a place not ordinarily used as a regular sleeping accommodation for humans, such as the streets, vehicles, or parks) (Henry et al., 2017).

Medicaid Expansion

In this study, states that did not adopt Medicaid expansion at any point (control states) were compared to states that had limited or no expanded Medicaid eligibility requirements prior to formal Medicaid expansion in 2014 (treatment states). This restricted group of expansion states was chosen in particular to better isolate the causal impact of ACA-driven expansion on homelessness outcomes by creating more distinct treatment (i.e., expansion states that “cleanly” expanded Medicaid under the ACA with few previous eligibility expansion measures in place) and control (i.e., non-expansion)

groups. Prior research has demonstrated that restricting analysis to this subgroup of expansion states allows for increased signal strength of Medicaid expansion impacts (Simon, Soni, & Cawley, 2016).

Therefore, following a previous classification approach (Simon et al., 2016; Wherry & Miller, 2016), ten states (California, Connecticut, Delaware, District of Columbia, Hawaii, Massachusetts, Minnesota, New York, Vermont, and Wisconsin) were excluded from the treatment group in all analyses, because these states had partial or full Medicaid or public insurance expansions in place prior to formal ACA expansion. Five of these states (California, Connecticut, Hawaii, Minnesota, and Wisconsin) had partial Medicaid or public insurance eligibility for low-income, childless adults before 2014, while the remaining five states (Delaware, District of Columbia, Massachusetts, New York, and Vermont) had the most expansive Medicaid eligibility requirements in place before 2014. In addition, Alaska and US territories were excluded from analyses.

After these exclusions were made, 20 states were ultimately included in the group of expansion states: Arizona, Arkansas, Colorado, Illinois, Indiana, Iowa, Kentucky, Maryland, Michigan, New Hampshire, New Jersey, North Dakota, New Mexico, Nevada, Ohio, Oregon, Pennsylvania, Rhode Island, Washington, and West Virginia. The non-expansion group was also composed of 20 states: Alabama, Florida, Georgia, Idaho, Kansas, Louisiana, Maine, Mississippi, Missouri, Montana, Nebraska, North Carolina, Oklahoma, South Carolina, South Dakota, Tennessee, Texas, Utah, Virginia, and Wyoming.

For states in the expansion group, Medicaid expansion status was classified as a binary indicator based on whether a state had implemented Medicaid expansion in a

given year. In expansion states, coverage became effective January 1, 2014 with the exception of six states in which implementation occurred at a later date: Michigan (4/1/2014), New Hampshire (8/15/2014), Pennsylvania (1/1/2015), Indiana (2/1/2015), Montana (1/1/2016), and Louisiana (7/1/2016). For these states, expansion indicator was assigned for that year if implementation occurred before June 30 (Michigan, Pennsylvania, Indiana, and Montana), and the following year if implementation occurred July 1 or after (New Hampshire and Louisiana) (Gates & Rudowitz, 2014).

Covariates

Several state-level, time-varying characteristics were included in these analyses to control for trends that may differentially impact rates of homelessness across states. Potential confounders were selected based on a review of empirical macro-level determinants of homelessness (Bohanon, 1991; Mansur et al., 2002; Quigley & Raphael, 2004). Final models included controls for poverty and unemployment rates, income inequality, availability of affordable housing, and housing prices. Data for poverty rates, income inequality, and affordable housing availability were obtained from publicly available American Community Survey (ACS) data, administered by the US Census Bureau to generate annual state-level estimates related to sociodemographic and economic composition. Poverty rates were defined as the proportion of state residents living below the official federal poverty line (FPL) in a given year. Income inequality was defined as the ratio of the share of income going to the top-earning quintile of households and the share of income going to the bottom quintile of households in a given year. Affordable housing availability was measured by the number of apartments or other

rental units that were affordable and available for every 100 renter households with very-low incomes in a given year, with very low-income households defined as those with income at or below 50% of the area median income in a given year.

For estimates of state-level unemployment rates, Bureau of Labor Statistics data were used to derive the annual mean proportion of state residents in the labor force (i.e., who have jobs or are actively looking for jobs) who are not employed. An additional measure of housing availability was derived from the US Federal Housing Finance Agency House Price Index (HPI), which measures average price changes in repeat sales or refinancings on the same properties. Finally, as an additional control, the number of Continuum of Care (CoC) organizations within a state was included as a proxy for level of homelessness service activity and coordination in a given state-year. In addition, this variable served as a proxy for data quality for homelessness estimates, since CoCs are responsible for coordinating housing and relevant social services for people who experience homelessness in their service area and for conducting the annual homelessness point-in-time counts .

Statistical Analysis

The effect of Medicaid expansion on state-level homelessness rates was modeled using a two-way fixed effects approach that included both state and year fixed effects and relevant state-level, time-varying covariates in the model. Possible collinearity among covariates was evaluated and ruled out. The impact of Medicaid expansion on overall homelessness rates was modeled, as well as rates for the following homeless subgroups: individuals, individuals in families with children, veterans, and chronically homeless

individuals. In addition, each outcome of interest was further stratified by sheltered or unsheltered status. All analyses were conducted in SAS Version 9.4.

Limitations

This study has important limitations. First, given a lack of sufficiently granular data, direct effects of expanded Medicaid eligibility on rates of homelessness may not be detectable. Although more frequent (e.g., quarterly or monthly) estimates of the outcome measure would have increased the ability of this study to detect changes over time, state-level estimates of homelessness are only available by calendar year. Another limitation of this study is the lack of data on rates of Medicaid uptake specifically among housing unstable or homeless populations by state. Together, these limitations reduce the level of certainty that any changes in rates of homelessness are directly attributable to Medicaid enrollment, despite the use of rigorous econometric methods to examine this relationship. In addition, these limitations may bias results toward the null.

Second, there are additional limitations inherent in the data used to estimate rates of homelessness by state. National point-in-time counts of homelessness are collected on a single night in January each year. In most cases, individuals who experience homelessness do so for brief, repeated periods of time (Culhane et al., 2007; Kuhn & Culhane, 1998). In addition, estimates of sheltered homelessness exclude individuals who are “doubled up” with family or friends out of financial necessity or who use privately funded shelters that do not receive federal homelessness assistance funding, which are not included in official HUD counts. Point-in-time counts also tend to bias toward counting chronic, long-term homeless individuals who live on the streets or in shelters for

extended periods of time, while underestimating the extent of episodic, short-term homelessness. In addition, methods and quality of reporting may vary by the capacity of local agencies charged with overseeing and implementing the annual homelessness count (Troisi, D'Andrea, Grier, & Williams, 2015). Therefore, official point-in-time counts likely underestimate the true extent of homelessness in the United States.

The measurement errors inherent in obtaining homelessness counts would only affect the results of this study if they systematically vary across states. There is no evidence that this is the case and one would not expect a bias in the results attributable to this concern. However, to further control for this possibility, the statewide number of CoCs was included in adjusted model specifications as a proxy for level of homelessness service capacity and subsequent data quality of annual homelessness estimates.

Results

Regardless of expansion status, overall rates of homelessness decreased from 2010-2017 by 28.7% from 16.7 to 11.9 per 10,000 across all states in the study sample. Trends in homelessness among each population subgroup followed a similar pattern across all states over time: homelessness decreased by 19.2% among individuals (10.4 to 8.4 per 10,000), by 42.9% among individuals in families (6.3 to 3.6 per 10,000), by 45.0% among veterans (2.0 to 1.1 per 10,000), and by 36.0% among chronically homeless individuals (2.5 to 1.6 per 10,000).

Across the study period, unadjusted homelessness rates were highest among states that ultimately implemented Medicaid expansion (Table 3.1). From 2010-2017, the average rate of overall homelessness per 10,000 was 15.5 in expansion states and 13.2 in

non-expansion states ($p = 0.0021$). For homeless subgroups, the average rate was significantly higher in expansion states compared to non-expansion states for single individuals (9.9 vs. 8.6 per 10,000, $p = 0.0140$) and for individuals living in a family with children (5.6 vs. 4.6, $p = 0.0029$). Expansion states also had higher average unemployment rates across the study period (6.6% vs. 6.0%, $p = 0.0158$) and lower rates of affordable housing availability (63.6 vs. 68.5, $p = 0.0018$).

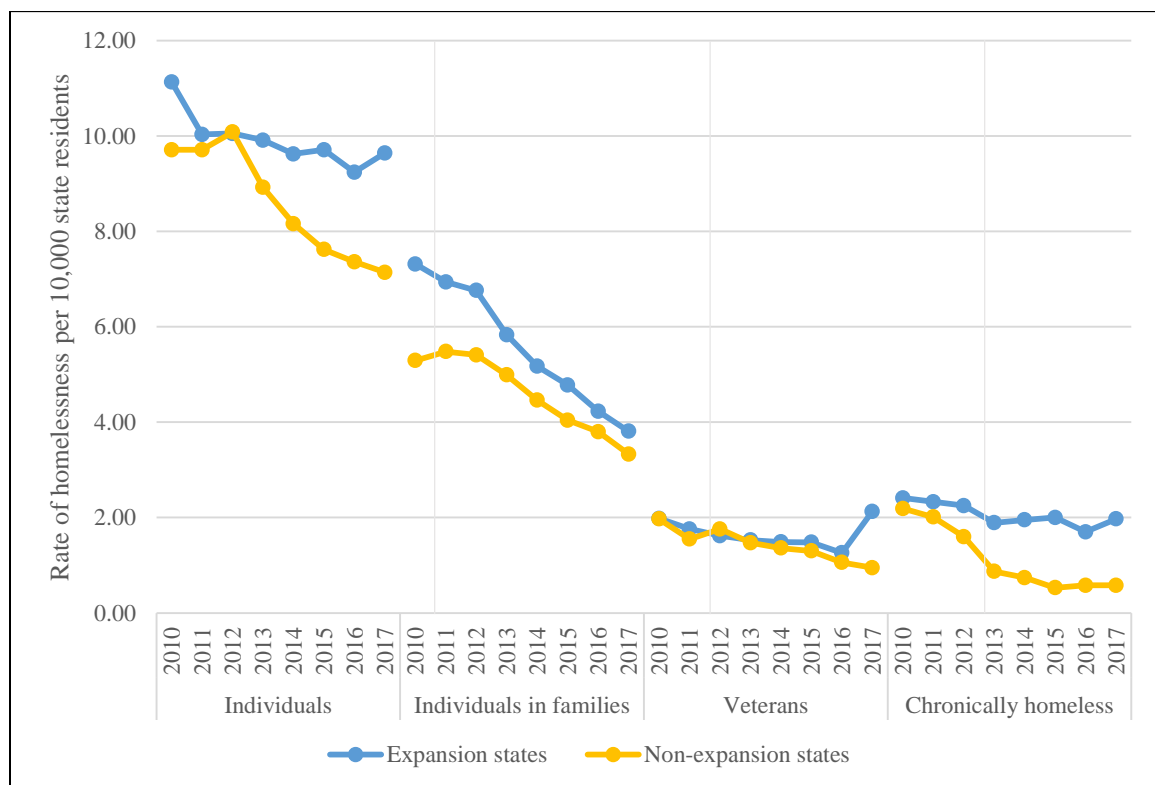
Table 3.1. Descriptive statistics for state panel data by expansion and non-expansion status, 2010-2017

	Expansion states (n = 20)			Non-expansion states (n = 20)		
	Mean	SD	Range	Mean	SD	Range
Overall homelessness**	15.5	8.4	7.2 - 50.8	13.2	4.8	4.9 - 31.4
Sheltered***	10.9	3.6	4.2 - 29.0	9.0	3.2	2.5 - 22.2
Unsheltered	4.7	5.8	0.2 - 32.0	4.2	4.0	0.2 - 23.2
Individuals*	9.9	6.1	4.7 - 35.4	8.6	3.4	3.7 - 22.6
Sheltered***	6.3	2.3	3.1 - 23.1	5.4	1.8	1.5 - 11.4
Unsheltered	3.6	4.3	0.2 - 18.4	3.2	3.0	0.2 - 17.5
Individuals in a family**	5.6	3.7	1.3 - 22.8	4.6	2.1	1.3 - 12.7
Sheltered***	4.6	2.2	1.1 - 14.5	3.6	1.7	1.0 - 10.8
Unsheltered	1.1	2.4	0.0 - 14.0	1.0	1.4	0.0 - 11.5
Chronically homeless	2.1	1.6	0.5 - 8.8	1.8	1.4	0.2 - 10.6
Sheltered**	1.0	0.5	0.2 - 2.7	0.8	0.5	0.0 - 2.4
Unsheltered	1.1	1.3	0.0 - 6.5	1.0	1.3	0.0 - 10.1
Veterans	1.5	1.0	0.5 - 6.8	1.4	0.7	0.2 - 5.4
Sheltered**	1.1	0.5	0.4 - 4.6	1.0	0.4	0.1 - 2.3
Unsheltered	0.4	0.6	0.0 - 2.5	0.5	0.5	0.0 - 3.3
Poverty rate	0.2	0.1	0.1 - 0.2	0.2	0.0	0.1 - 0.2
Income inequality	14.7	1.4	11.4 - 17.6	14.5	1.9	10.0 - 19.0
Unemployment*	6.6	2.3	2.6 - 13.5	6.0	2.0	2.9 - 11.2
Affordable housing**	63.6	14.7	37.0 - 99.0	68.5	13.3	35.0 - 103.0
Housing Price Index (HPI)	134.2	23.5	83.0 - 206.7	136.4	18.5	96.9 - 185.1
Number of CoCs	7.5	6.7	1.0 - 21.0	7.4	6.5	1.0 - 28.0

SOURCE Analysis of data for 2010-2017 from the US Department of Housing and Urban Development, US Census Bureau, US Bureau of Labor Statistics, and US Federal Housing Finance Agency. **NOTES** Sample size is n = 160 state-years for expansion states and n = 160 state-years for non-expansion states. Homelessness means are expressed as rate per 10,000 state population. CoC is Continuum of Care. Differences in expansion vs. non-expansion group means were tested using Student's *t* test of independent means. Level of significance is denoted as * $p < 0.05$, ** $p < 0.01$, and *** $p < 0.001$.

Over time, in states implementing Medicaid expansion, overall homelessness during 2010-2017 decreased by 31.9%, from 18.8 to 12.8 per 10,000 residents. In non-expansion states, homelessness decreased by 28.9% (14.2 to 10.1 per 10,000) over the

same period. For specific subgroups, homelessness: decreased among individuals by 26.5% in expansion states and 13.3% in non-expansion states; decreased among individuals living in a family with children, by 47.9% in expansion states and 37.1% in non-expansion states; among veterans, increased in expansion states by 7.6% and decreased in non-expansion states by 51.8%; and decreased among individuals experiencing chronic homelessness by 18.3% in expansion states and 73.5% in non-expansion states (see Figure 3.1).



SOURCES Homelessness counts from US Department of Housing and Urban Development data, 2010-2017. State population estimates from US Census Bureau. **NOTES** Rates are expressed as homelessness per 10,000 state population. “Individuals” refer to persons who are not part of a family with children during an episode of homelessness. “Individuals in families” refers to adults who are homeless as part of a household that has at least one child (under age 18). “Chronically homeless” denotes individuals with a disability who have been continuously homeless for one year or more or have experienced at least four episodes of homelessness in the last three years.

Figure 3.1. State homelessness rates by population subgroup for expansion and non-expansion states

In adjusted models (Table 3.2), Medicaid expansion was not significantly associated with changes in rates of overall homelessness ($B = 0.17, p = 0.77$) or rates of homelessness among single adults ($B = 0.73, p = 0.10$), veterans ($B = 0.09, p = 0.11$), or adults experiencing chronic homelessness ($B = 0.19, p = 0.34$). However, among individuals living in a family with children, a statistically significant decrease in homelessness was observed, amounting to a reduction of 0.64 per 10,000 residents of expansion states ($p = 0.05$). Sub-analyses indicate that this decrease was driven by reductions in homelessness among individuals in families living in shelters or transitional housing ($B = -0.57, p = 0.0003$), with a smaller and non-significant decrease among those living in unsheltered conditions ($B = -0.07, p = 0.80$). Among the model covariates, a small but statistically significant positive relationship was observed between rates of homelessness among individuals in a family and state-year Housing Price Index (HPI) values ($B = -0.05, p < 0.001$).

Table 3.2. Adjusted estimates of the impact of Medicaid expansion on homelessness per 10,000 (overall and by homeless subgroup), 2010-2017

	Overall	Individuals	Individuals in a family	Veterans	Chronically homeless individuals
	<i>B</i> (SE)	<i>B</i> (SE)	<i>B</i> (SE)	<i>B</i> (SE)	<i>B</i> (SE)
Expanded Medicaid	0.17 (0.59)	0.81 (0.42)	-0.64 (0.33)*	0.08 (0.10)	0.34 (0.19)
Poverty rate	-0.41 (2.31)	-0.17 (1.64)	-0.24 (1.29)	0.14 (0.39)	-0.01 (0.73)
Income inequality	0.18 (0.40)	0.00 (0.28)	0.18 (0.22)	-0.01 (0.07)	-0.31 (0.13)**
Unemployment	0.34 (0.21)	0.22 (0.15)	0.12 (0.11)	0.04 (0.04)	0.01 (0.07)
Affordable housing	0.02 (0.05)	0.01 (0.03)	0.12 (0.03)	0.01 (0.01)	0.01 (0.06)
House Price Index	-0.04 (0.02)	0.02 (0.02)	-0.05 (0.01)***	-0.01 (0.00)*	-0.00 (0.01)
Number of CoCs	0.21 (0.24)	0.03 (0.17)	0.18 (0.13)	-0.02 (0.04)	-0.01 (0.07)

SOURCE Authors' analysis of data for 2010-2017 from the US Department of Housing and Urban Development, US Census Bureau, US Bureau of Labor Statistics, and US Federal Housing Finance Agency. **NOTES** Estimates are from state and year fixed effects regressions of homelessness overall and subgroup rates on Medicaid expansion status, controlling for relevant covariates. SE is standard error. CoC is Continuum of Care. Level of significance is denoted as * $p < 0.05$, ** $p < 0.01$, and *** $p < 0.001$.

Discussion

In this study, a quasi-experimental design was applied to examine the impact of changes to Medicaid expansion eligibility on rates of homelessness, both in the general population and among specific homeless subgroups. Medicaid expansion was associated with a modest but statistically significant decrease in rates of homelessness among adults in families with children, with no corresponding changes in homelessness among individual adults or among control subgroups, comprising veterans and individuals who are chronically homeless. The absence of any significant changes in rates of homelessness among these subgroups, which were hypothesized would not be sensitive to

Medicaid expansion due to pre-ACA insurance access, lends additional confidence that the decrease in homelessness among families observed in this study is indeed attributable to gains in health insurance coverage among individuals in families living in expansion states. In addition, the observed decrease in family homelessness appears to be driven by a decline in the rate of individuals in families living in shelters or transitional housing. Specifically, it is theorized that sheltered families may be better connected with case management and social services than unsheltered families, and therefore have an easier time establishing state residency, facilitating enrollment in Medicaid and eventual exit from homelessness.

As expected, differential effects of Medicaid expansion on homeless subgroups were observed. For example, most veterans are already eligible for health insurance coverage and low-cost care under TRICARE and other US Department of Veteran Affairs (VA) programs. In addition, individuals who experience chronic homelessness by definition have a qualifying disability and were Medicaid-eligible under pre-ACA eligibility requirements. Correspondingly, no significant impacts of Medicaid expansion on rates of homelessness were observed among these subgroups. Conversely, many non-elderly, low-income single adults historically have not been eligible for targeted, publicly subsidized programs, including state Medicaid assistance. Similarly, although children in low-income families are often eligible for public health insurance coverage options, their parent or guardian may not have access to such coverage. Therefore, results from this study are consistent with the expectation that adult heads of households stood to benefit most from expanded Medicaid eligibility, given that they have previously been most vulnerable to high costs resulting from serious or unexpected medical concerns.

The effectiveness of public policies that facilitate individual access to health insurance coverage, such as Medicaid expansion under the ACA, depends fundamentally on whether such policies actually improve the financial security of those who gain coverage. Generally, the evidence strongly suggested a relationship between gaining health insurance and a variety of desirable financial outcomes, including less difficulty paying medical bills (Barcellos & Jacobson, 2015; Hu, Kaestner, et al., 2016), lower personal bankruptcy rates (Gross & Notowidigdo, 2011; Hu, Kaestner, et al., 2016; Mazumder & Miller, 2016), improved credit scores (Mazumder & Miller, 2016), lower out-of-pocket medical expenditures (Barcellos & Jacobson, 2015), and lower overall debt (Gross & Notowidigdo, 2011; Hu, Kaestner, et al., 2016; Mazumder & Miller, 2016). Specifically, recent evidence suggests that ACA-driven Medicaid expansion has reduced out-of-pocket spending among beneficiaries and reduced the national poverty rate by under 1 percentage point (Zewde & Wimer, 2019). However, the lack of data on uptake and Medicaid enrollment among individuals who experience housing instability or homelessness prevents a more nuanced examination of coverage uptake and subsequent financial impacts in this population.

Continued research is needed to further bolster our understanding of the relationship between Medicaid and housing-related outcomes, as well as sustained enrollment efforts in states that have adopted expanded eligibility requirements. Although expanded Medicaid eligibility requires substantial state investment, it is important to understand how these costs may be offset by positive impacts on health and social domains, including housing and homelessness. Early evidence has documented budget savings and even revenue gains in some expansion states, despite high levels of

enrollments of previously ineligible individuals, through mechanisms like federal matching for Medicaid expenditures and budget offsets in behavioral health and corrections (Dorn, Francis, Snyder, & Rudowitz, 2015; Sommers & Gruber, 2017). Similarly, reductions in homelessness as a result of Medicaid expansion could contribute to decreased spending on needs associated with homelessness that states and localities are otherwise responsible for providing, like law enforcement, social, and emergency services (Dorn & Buettgens, 2010). In addition, evidence suggests that homeless individuals without any form of health insurance have a significantly lower likelihood of obtaining and maintaining permanent housing, which substantially increases the costs incurred to society (Meschede, 2010).

CHAPTER 4: FACTORS ASSOCIATED WITH CLINICAL QUALITY PERFORMANCE AMONG HEALTH CARE FOR THE HOMELESS FEDERALLY QUALIFIED HEALTH CENTERS

Introduction

Homelessness has a significant adverse effect on health status and is associated with a burden of morbidity 3 to 6 times higher than that among the general US population (Gelberg, 1989; Hwang, 2001; Lebrun-Harris et al., 2013; Martens, 2000; Zlotnick & Zerger, 2009). Individuals who are homeless face substantial barriers to accessing routine primary health care services, including lack of health insurance (Oates et al., 2009), inadequate transportation (Gelberg, Browner, Lejano, & Arangua, 2004; Wood & Valdez, 1991), and competing priorities related to being homeless that take precedence over obtaining medical care, such as meeting basic needs related to food, shelter, and clothing (Chwastiak et al., 2012; Gallagher et al., 1997; Gelberg et al., 1997). Even when connected to health care services, homeless persons continue to face challenges to disease management and treatment adherence. For example, lack of stable and secure housing can hinder patient ability to store and dose medications properly (Coe, Moczygemba, Gatewood, et al., 2015) or avoid physical strain and exposure during post-operative recuperation (Buchanan et al., 2006), underscoring the importance of primary care services tailored to serve this vulnerable and unique patient population.

Therefore, in order to better serve individuals and families experiencing homelessness, some federally qualified health centers in the United States receive Health Care for the Homeless (HCH) funding under the Health Resources and Services Administration (HRSA) Section 330(h) federal grant program. While all federally

qualified health centers provide care to vulnerable people in their communities, some of whom may be homeless, HCH-funded health centers are explicitly tasked with meeting the unique health care and social needs of homeless patients. Specifically, HCH grantees are given funding to employ homeless-tailored outreach and engagement efforts, such as mobile or temporary clinics at shelters and other sites. In addition, HCH grantees are expected to form multidisciplinary collaborations with other community health providers and social service agencies to offer housing assistance, food and clothing, legal services, and vocational training, and to hire or contract with case managers (Zlotnick et al., 2013). Eligible federally qualified health centers receive HCH funding through a competitive application process, with funding allocated proportionally to the health center patient catchment area (Boyer, Poe, & DiPietro, 2017). HCH-funded health centers comprise the sole federal mechanism responsible for addressing the primary health care needs of the homeless in the US general population (Zlotnick et al., 2013), and are a vital component of the nation's health care safety net, serving over 1 million patients in 2017 (Swofford, 2011).

Previous research on the quality of care delivered by HCH-funded health centers has demonstrated high levels of patient-reported satisfaction among both homeless and housed patients (Kertesz et al., 2013; O'Connell et al., 2010). However, examinations of care delivery at HCH-funded health centers have largely been descriptive, focusing on health behaviors (Baggett, Campbell, Chang, & Rigotti, 2016; Stringfellow et al., 2016), disease prevalence (Baggett et al., 2015; Lebrun-Harris et al., 2013), and patterns of service utilization (Lebrun-Harris et al., 2013; Lin et al., 2015) among patients receiving care at these sites. In addition, most extant research on HCH-funded health centers has

drawn conclusions from patient surveys (Lebrun-Harris et al., 2013; Zur & Jones, 2014) or data from single-site and regional grantee evaluations (Baggett et al., 2015; Han & Wells, 2003; O'Connell et al., 2010), limiting the strength and generalizability of the evidence base in this area. To this point, no previous studies on HCH-funded health centers have taken advantage of publicly available, longitudinal data on the universe of federally qualified health centers reported annually by HRSA. The Uniform Data System (UDS), which requires all federally funded health centers to submit information to HRSA about a range of past-year patient population characteristics, staffing, costs, revenues, and clinical quality indicators (US Health Resources and Services Administration, 2017), represents the most comprehensive source of available data on federally qualified health centers (DiPietro et al., 2014). UDS data have been widely used to evaluate quality in federally qualified health centers generally (Shi et al., 2012; Shi et al., 2015; Shin et al., 2013), but no studies have focused on correlates of clinical quality among the subset of federally qualified health centers that receive HCH funding and are tasked with meeting the primary care and social needs of homeless patients throughout the country.

Therefore, the objective of the present study was to examine organizational characteristics associated with quality among the subset of federally qualified health centers that receive targeted HCH funding to better serve homeless patients. In order to optimize the delivery of primary health care services to this unique and extremely vulnerable patient population, it is necessary to gain further insight into determinants of quality of care, including the role of grant funding and health center characteristics, within the nation's sole primary care network for the homeless. By using national, longitudinal data on the full subset of HCH-funded health centers, the present study

broadens previous work that is limited in generalizability or focused on descriptive characteristics of homeless patients served (Baggett et al., 2016; Baggett et al., 2015; Han & Wells, 2003; Lebrun-Harris et al., 2013; Stringfellow et al., 2016; Zur & Jones, 2014). Furthermore, in light of continuing debate around health care financing and delivery in the United States, the federally qualified health center program as a whole faces ongoing legislative scrutiny (Rosenbaum, 2017; Swartz, August 17, 2018). Given the scope and importance of HCH health centers in the nation's network of safety net providers, it is important to identify determinants of quality care and evaluate the contribution of targeted grant funding in improving clinical quality among patients who experience homelessness.

Methods

Data

This pooled cross-sectional used retrospective panel data to analyze performance on health center-level clinical quality indicators as a function of HCH funding per homeless patient, year, and other health center characteristics. All analyses were conducted on data from the Uniform Data System (UDS), a tracking and reporting system administered by HRSA. The UDS is used to collect information annually from all federally qualified health centers on past-year patient characteristics and volume, operations, costs, revenue, and clinical indicators. For this study, panel data were constructed using publicly available UDS data for years 2014-2017 by matching on HRSA grantee identification number. Health centers receiving any amount of HCH

funding in any year or years of the study period (2014-2017) were included. The unit of observation for all analyses was the health center-year.

Measures

Health Care for the Homeless (HCH) Funding Per Homeless Patient

The primary independent variable of interest was the amount of HCH funding received per homeless patient. HCH funding is awarded under Section 330(h) of the Public Health Service Act (Section 330 of the Public Health Service Act: Authorizing legislation of the health center program, 2013) through a competitive grant application process for three-year project periods, subject to renewal. By federal statute, the HCH program receives 8.7% of HRSA's total health center program appropriation annually (*Health for the Homeless program fact sheet*, 2011). HCH funding is allocated directly to health centers by HRSA (i.e., not disbursed indirectly through state agencies). A measure of HCH funding per homeless patient was constructed by dividing the dollar amount of HCH funding received by the number of homeless patients reported by each health center each year per health center-year. Prior to construction of this measure, HCH funding for each year was adjusted for inflation and expressed in 2017 US dollars.

Clinical Quality Indicators

The main dependent variables examined were a series of clinical quality indicators derived from data in the UDS. Specifically, all HRSA-funded federally qualified health centers are required to report on a standardized set of grantee-level performance measures related to clinical quality each calendar year. HRSA selects measures that align with those used by the Centers for Medicare and Medicaid Services

(CMS) and other health insurance and managed care organizations to assess clinical quality performance, with an emphasis on measures most relevant to health concerns that are common among the underserved or vulnerable patient populations targeted by federally qualified community health centers. Although HRSA collects information on multiple indicators of clinical quality, for this study process measures of quality (Types of health care quality measures, 2011) were specifically included as outcomes. Process measures related to screening and treatment are thought to be more sensitive to changes in funding (Mainz, 2003) and include measures over which federally qualified health centers may have more proximal control (e.g., medication management, preventive screenings) than more distal outcomes related to health status, such as glycemic control or tobacco cessation.

Therefore, the following six process measures of quality were chosen as outcomes for the present study: 1) body mass index (BMI) screening and follow-up among adults aged 18 years and older; 2) cervical cancer screening among women ages 21-64 years; 3) tobacco use screening and cessation intervention among adult patients aged 18 years and older; 4) appropriate medication management for asthma among patients 5-64 years of age; 5) lipid therapy among adult patients diagnosed with coronary artery disease; and 6) colorectal cancer screening among adults 50-75 years of age. Health centers report these clinical indicators as the percent of patients with a given diagnosis or health concern who have been provided with the appropriate medication, intervention, or counseling. For example, the coronary artery disease outcome is expressed as the percent of adult patients with a diagnosis of coronary artery disease who have been prescribed lipid-lowering therapy. See Table 4.1 for further measurement details for each clinical quality indicator.

Table 4.1. Health Resources and Services Administration (HRSA) clinical quality indicators and definitions

Quality indicator	Definition
BMI screening and follow-up plan	Percent of patients aged 18 years and older with recent BMI documentation and, for patients with a BMI outside of normal parameters (for patients ages 18-64 years, BMI < 18.5 kg/m ² or ≥ 25 kg/m ² ; ages 65 years and older, BMI < 23 kg/m ² and ≥ 30 kg/m ²), a follow-up plan documented.
Cervical cancer screening	Percent of female patients 21-64 years of age receiving one or more Pap tests to screen for cervical cancer one during the measurement period or in the two years prior to the measurement period.
Tobacco use screening and cessation intervention	Percent of patients 18 years and older screened for tobacco use one or more times within 24 months and who received cessation counseling intervention if identified as a tobacco user.
Asthma medication management	Percent of patients 5-64 years of age identified as having persistent asthma and appropriately prescribed medication.
Lipid therapy for coronary artery disease	Percent of patients aged 18 years and older with an active diagnosis of coronary artery disease (CAD), including any diagnosis for myocardial infarction (MI) or who had had cardiac surgery in the past, prescribed a lipid-lowering therapy.
Colorectal cancer screening	Percent of adults 50-75 years of age with appropriate screening for colorectal cancer. Appropriate screenings include: fecal occult blood test (FOBT) during the measurement period; flexible sigmoidoscopy during the measurement period or the four years prior to the measurement period; or colonoscopy during the measurement period or the nine years prior to the measurement period.

SOURCE US Health Resources & Services Administration (HRSA), Bureau of Primary Health Care, Health Center Program. “Quality of care.” Last updated November 2018. <https://bphc.hrsa.gov/qualityimprovement/performance/qualitycare.html>

These six specific quality indicators were selected as outcomes because 1) each has been consistently reported in the UDS over the study period (2014-2017) without change in measurement properties, and 2) these indicators highlight health concerns of particular relevance to homeless and marginally housed patient populations. For instance, cardiovascular disease has been the leading cause of mortality among homeless men for several years (Baggett et al., 2013; Hwang, Orav, O'connell, Lebow, & Brennan, 1997; Lee et al., 2005), supporting the value in the present study of including the UDS quality indicator for lipid therapy among patients with coronary artery disease. In addition, homeless women are at increased risk for contracting sexually transmitted diseases, including the human papillomavirus (HPV) (Davis, Goddard-Eckrich, Dasgupta, & El-Bassel, 2018; Williams & Bryant, 2018), but have little knowledge about the relationship between HPV and cervical cancer (Asgary et al., 2015, 2016); the prevalence of asthma among homeless children is 6 times the national rate for children in the general population (McLean et al., 2004); and, across gender and age groups, people who experience homelessness are significantly more likely than people who are not homeless to smoke cigarettes and use other tobacco products (Arnsten, Reid, Bierer, & Rigotti, 2004; Baggett et al., 2016; Lee et al., 2005). However, it is important to note that clinical quality indicators are reported in the UDS at the health center-level only and are not reported for individual patient subgroups (i.e., for homeless patients separately). Therefore, all analyses in this study are derived from data for all HCH-funded health center patients, not just patients reported as homeless.

Other Measures

Relevant health center and patient population characteristics were included as covariates in these analyses based on a review of extant research on determinants of federally qualified health center quality performance (Hu et al., 2018; Khanna, Shaya, Chirikov, Sharp, & Steffen, 2016; Riehman, Stephens, Henry-Tanner, & Brooks, 2018; Shi et al., 2012; Shi et al., 2015). Health center characteristics evaluated include health center size (measured as total annual volume of patients and split into equal tertiles for analysis, such that “small” = $\leq 8,620$ patients, “medium” = 8,621-24,326 patients, and “large” = $\geq 24,327$ patients); setting (urban or rural); and total revenue per year (in US dollars). Total revenue captures all third-party payments (from Medicaid, Medicare, other public insurance, private insurance, and patient self-pay); HRSA Health Center Program grants (e.g., Healthcare for the Homeless funding, Migrant Health Center funding); federal, state, and other grant funding; and any other source of revenue during the reporting year. Total revenue was adjusted for inflation and expressed in 2017 US dollars. In addition, a dichotomous variable was constructed to indicate whether a health center was in its first year of HCH funding during the study period (e.g., if a health center received HCH funding in 2015-2017 but not in 2014). Patient population characteristics assessed include proportion of health center patients in a given year who were female; proportion of patients who reported a race other than white; proportion who were Hispanic; proportion who were children (under 18 years); proportion who were at an income below 200% of the federal poverty level (FPL); proportion who were uninsured; and proportion who were homeless.

Consistent with previous studies (Shi et al., 2012; Shi et al., 2015), a variable was also included to indicate the method used by a health center to report quality measures to the UDS. For reporting on clinical quality indicators each year, health centers choose between reporting on their entire patient population through automatic extraction using an EHR system, or extracting data from a randomly selected subset of 70 patients for each quality indicator based on manual chart review (US Health Resources and Services Administration, 2017). In previous research, health centers reporting on the universe of patients using an EHR system have been associated with worse performance on clinical quality indicators than those using manual chart review, due to the potential introduction of bias from any non-random selection methods used to identify patients for manual chart review (Shi et al., 2012; Shi et al., 2015).

Analysis

To analyze these data, descriptive statistics were computed for key variables among HCH-funded health centers using pooled data from all years of the study period (2014-2017). Descriptive statistics for each year were separately calculated for the primary independent variables (total HCH funding and HCH funding per homeless patient) and outcome measures (each of the six quality indicators). Bivariate correlations were conducted to assess the unadjusted relationships between HCH funding per homeless patient and each of the six quality indicators, using nonparametric Spearman correlations (ρ) given the highly skewed distribution of values for HCH funding per homeless patient.

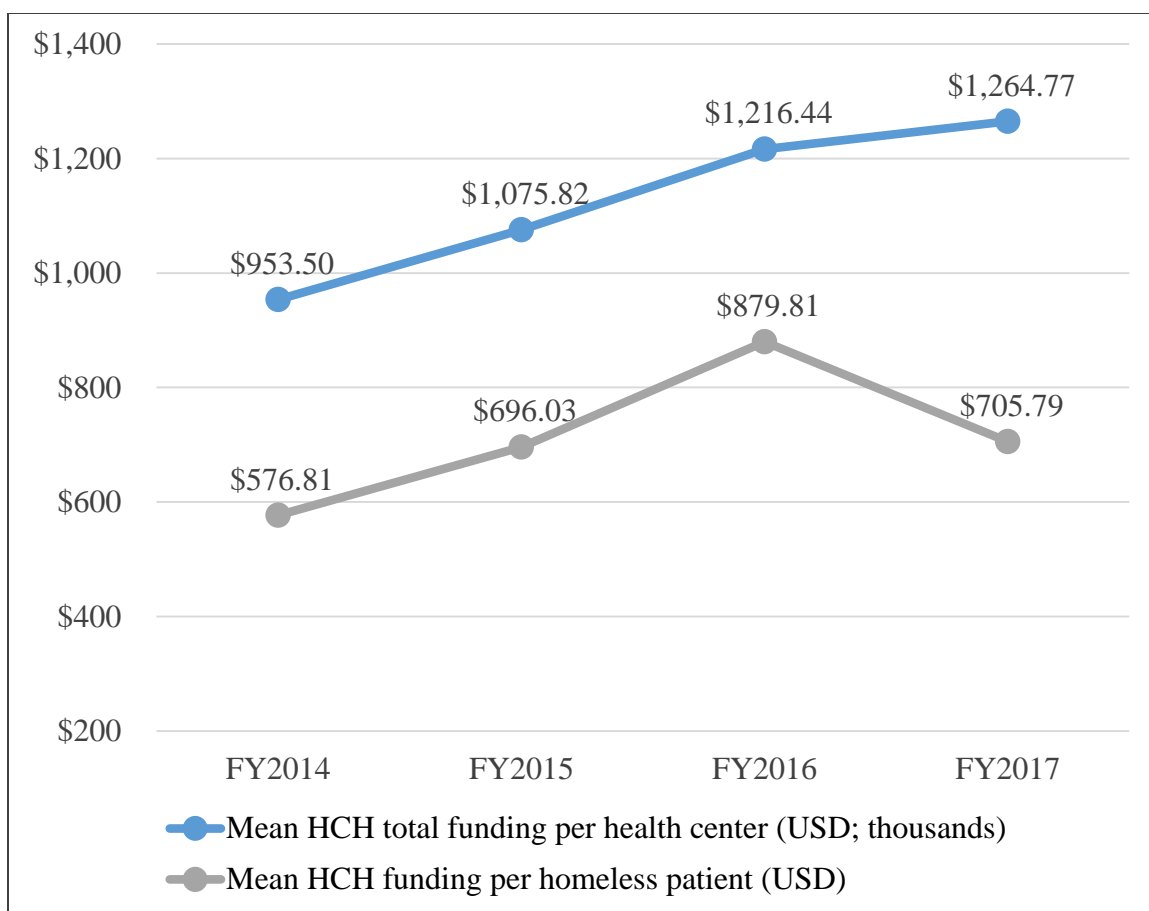
Multivariable linear regression analyses were used to examine associations between HCH funding per homeless patient and each quality indicator. Each of the six quality indicators was modeled separately as a function of HCH funding per homeless patient, year, and other covariates, using a restricted maximum likelihood approach with state-level random effects. State-level random effects were chosen to account for potential correlation between health centers operating in the same state within common bounds of state policies, practices, and other unobservable factors that may affect clinical quality. In the final model specification, year (2014, 2015, 2016, or 2017), UDS reporting mechanism (EHR or manual chart review), first year of HCH funding (yes or no), health center setting (urban or rural), and health center size based on annual patient volume (small, medium, or large) were included as categorical variables. All other variables were included in the models as continuous measures.

In addition to primary analyses, subgroup analyses were conducted using the model specifications outlined above on the subset of health centers with a high proportion of homeless patients in a given year. “High” proportion of homeless patients was defined as a patient population for a given health center-year in which $\geq 38.7\%$ of all patients were homeless (the top quartile for percent of homeless patients based on the distribution of this variable in the full sample of health center-years).

Statistical significance was determined using the conventional alpha level of 0.05. All analyses were conducted in SAS Version 9.4 (Cary, North Carolina).

Results

Between 2014 and 2017, the number of health centers receiving HCH funding increased from 266 to 298 health centers. Over this study period, the average amount of HCH funding awarded to each health center annually was \$1,132,592 (median = \$727,135; range = \$4,100 – \$8,217,110). When examined by year, inflation adjusted HCH funding awarded per health center grew from an average of \$953,500 in 2014 to \$1,264,770 in 2017, an increase of 24.6% (Figure 4.1). From pooled data for 2014-2017, the average amount of HCH funding allocated per homeless patient during this period was \$733.55 (median = \$450.70; range = \$14.13 - \$32,838.15). Average inflation adjusted HCH funding per homeless patient grew by 34.4% between 2014 and 2016, but decreased by 24.7% between 2016 and 2017 (see Figure 4.1).



NOTES Funding variables are adjusted for inflation and expressed in 2017 USD.

Figure 4.1. Health Care for the Homeless (HCH) mean funding per health center and mean funding per homeless patient by year (2014-2017)

Table 4.2 presents health center and patient population characteristics for all HCH-funded health centers from pooled data for 2014-2017 ($n = 1,142$ health center-years). The average annual patient volume over this period was 26,055 patients (median = 15,033), with wide variation observed ($SD = 29,842$; range = 28 patients to 210,894 patients). On average, over one-quarter (mean = 27.8%; $SD = 34.0\%$) of patients served by an HCH-funded health center during this time period was homeless. The majority of HCH-funded health centers (82.9%) operated in urban areas. Patient populations were, on

average, largely composed of white (mean = 52.8%; SD = 25.6%) and adult (mean = 77.1%; SD = 14.7%) patients, with a roughly equal mix of male and female patients. Approximately one-quarter of patients were Hispanic (mean = 28.9%; SD = 24.3%). Most patients were either covered by Medicaid (mean = 47.9%; SD = 19.8%) or uninsured (mean = 31.7%; SD = 21.0%). On average, a small proportion of patients (mean = 4.0%; SD = 2.0%) reported an income \leq 200% FPL.

Table 4.2. Health center and patient characteristics for all Health Care for the Homeless (HCH)-funded health centers (n = 298), 2014-2017

	Mean (n)	Median (%)	Std. Dev.
Funding (USD)			
Total revenue	\$8,334,962.82	\$5,529,436.32	\$9,505,522.76
Total HCH program funding	\$1,132,591.80	\$727,135.22	\$1,188,612.88
HCH funding per homeless patient	\$733.55	\$450.70	\$1,472.06
Health center characteristics			
Total patients	24,650	14,423	28,971
Setting (n, %) ^a			
Urban	(247)	(82.9)	
Rural	(51)	(17.1)	
UDS reporting method (n, %)			
EHR	(1,088)	(95.3)	
Manual chart review	(54)	(4.7)	
Patient characteristics (%)			
Homeless	27.8	10.1	34.0
Female	53.7	56.0	8.4
Race			
White	52.8	54.6	25.6
Black	25.9	18.9	23.5
Other race	21.3	16.1	17.9
Hispanic or Latinx	28.9	23.5	24.3
Children (< 18 years)	22.9	22.5	14.7
Income ≥ 200% FPL	4.0	2.0	5.5
Uninsured	31.7	26.1	21.0
Medicaid	47.9	51.6	19.8

NOTES Analysis of pooled Uniform Data System (UDS) data for 2014-2017 from the US Health Resources and Services Agency (HRSA), Bureau of Primary Health Care (BPHC). Sample size is n = 1142 health center-years. Unless otherwise noted, means represent percent of health center patients across pooled sample. FPL is federal poverty level. ^aValues for the variable “setting” represent a fixed percentage.

In pooled data for 2014-2017 (Table 4.3), HCH-funded health centers demonstrated varying levels of performance among the six clinical quality indicators. The

highest average performance levels among the quality indicators assessed were reported for asthma medication management, measured as the percent of health center patients with asthma who had been appropriately prescribed medication (mean = 84.1%; SD = 17.0%) and tobacco use screening and cessation intervention, or the percent of tobacco users who had received cessation counseling (mean = 81.1%; SD = 17.3%). Average performance among the six quality indicators was lowest for colorectal cancer screening, measured as the percent of patients aged 50-75 years who had been screened appropriately for colorectal cancer (mean = 31.4%; SD = 17.1%), and cervical cancer screening, or the percent of female patients aged 21-64 who received a Pap test to screen for cervical cancer (mean = 47.6%; SD = 17.2%). In unadjusted bivariate correlations (Table 4.3), HCH funding per homeless patient was significantly associated with lower rates of colorectal cancer screening ($\rho = -0.123$; $p < 0.001$) and cervical cancer screening ($\rho = -0.168$; $p = < 0.001$) based on pooled data for 2014-2017. No statistically significant correlations were found between HCH funding per homeless patient and any of the remaining four quality indicators.

Table 4.3. Descriptive statistics for clinical quality indicators among Health Care for the Homeless (HCH)-funded health centers and correlations with level of HCH funding per homeless patient

Quality Indicator	Mean	Std. Dev.	Correlation with HCH funding per homeless patient (ρ)	p-value
BMI screening and follow-up	58.4	21.8	-0.030	0.315
Cervical cancer screening	47.6	17.2	-0.168	<0.0001
Tobacco use screening and cessation intervention	81.1	17.3	-0.036	0.227
Asthma medication management	84.1	16.9	0.008	0.787
Lipid therapy for coronary artery disease	77.8	14.5	0.006	0.829
Colorectal cancer screening	31.4	17.1	-0.123	<0.0001

NOTES Analysis of pooled Uniform Data System (UDS) data for 2014-2017. Sample size is $n = 1142$ health center-years. Means represent average percent of health center patients meeting quality indicator across pooled sample. Correlations derived using Spearman correlation coefficient (ρ)

When stratified by year (Figure 4.2), average performance among HCH-funded health centers on each of the six quality indicators trended upward over time with the exception of cervical cancer screening, which decreased slightly from 48.8% in 2014 to 47.8% in 2017. The most distinct increases over time were observed for colorectal cancer screening, which increased by 17.0% from 2014 (28.4% of patients aged 50-75 years screened) to 2017 (34.2% of patients screened), and BMI screening and follow-up, which

increased by 11.5% from 2014 (54.5% of adult patients with a BMI outside of normal parameters with a weight management plan in place) to 2017 (61.6% of patients with a weight management plan in place).

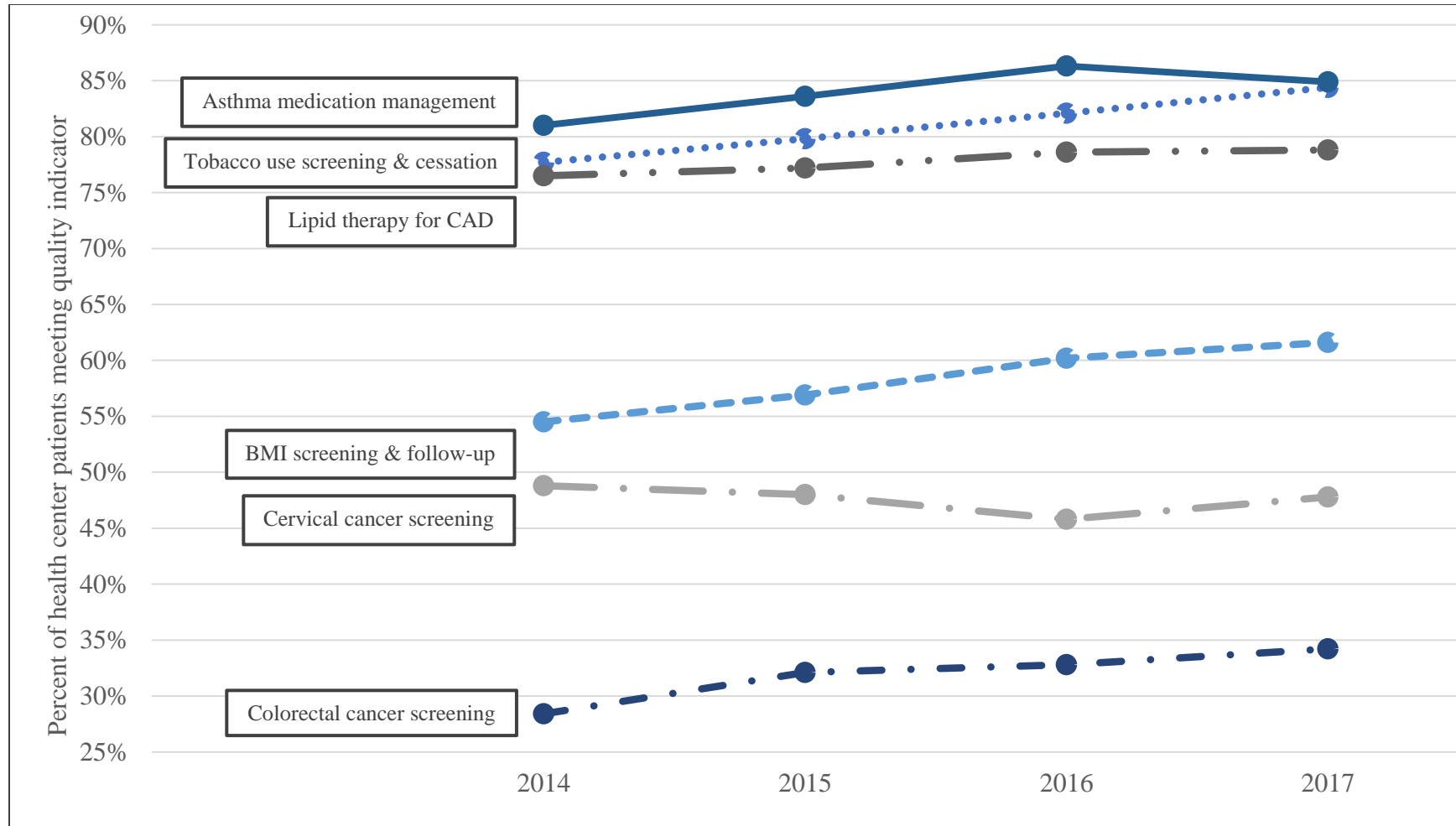


Figure 4.2. Mean performance on clinical quality indicators over time among Health Care for the Homeless (HCH)-funded health centers (2014-2017)

In adjusted results from multivariate regression analyses (Table 4.4), HCH funding per homeless patient was not statistically significantly associated with any of the six quality outcome indicators. However, other significant correlates of quality were identified for several quality indicators. A higher health center percentage of homeless patients was associated with worse performance on cervical cancer screening ($B = -0.06$; $SE = 0.03$; $p = 0.0364$) and asthma medication management ($B = -0.08$; $SE = 0.03$; $p = 0.0111$), while a higher percentage of female patients was associated with increased rates of colorectal cancer screening ($B = 0.27$; $SE = 0.11$; $p = 0.0170$) and cervical cancer screening ($B = 0.32$; $SE = 0.10$; $p = 0.0022$). In addition, a higher proportion of Hispanic patients was associated with better performance on cervical cancer screening ($B = 0.12$; $SE = 0.03$; $p = 0.0003$). Compared to small health centers, medium-sized health centers demonstrated significantly better performance on tobacco use screening and cessation intervention ($B = 3.80$; $SE = 1.63$; $p = 0.0203$) and lipid therapy for patients diagnosed with coronary artery disease ($B = 3.94$; $SE = 1.49$; $p = 0.0082$). Higher rates of lipid therapy for patients with coronary artery disease were also associated with large health centers ($B = 4.12$; $SE = 1.97$; $p = 0.0366$) compared to small health centers. Finally, higher total revenue was associated with better performance on both cervical cancer screening ($B = 239.66$; $SE = 83.71$; $p = 0.0043$) and tobacco use screening and cessation ($B = 175.71$; $SE = 78.60$; $p = 0.0256$).

Significant changes over time were observed for all six quality indicators. Compared to 2014, several indicators improved significantly in 2017, including BMI screening and follow-up ($B = 7.35$; $SE = 1.38$; $p < 0.0001$), tobacco use screening and cessation intervention ($B = 6.61$; $SE = 1.22$; $p < 0.0001$), asthma medication management

($B = 5.94$; $SE = 1.12$; $p = 0.0001$), colorectal cancer screening ($B = 5.94$; $SE = 1.12$; $p < 0.0001$), and lipid therapy for coronary artery disease ($B = 2.62$; $SE = 1.10$; $p = 0.0178$). In contrast, compared to 2014, rates of cervical cancer screening decreased significantly in 2016 ($B = -1.30$; $SE = 0.91$; $p < 0.0001$). Notably, health centers in their first year of HCH funding had lower average performance for BMI screening and follow-up ($B = -7.00$; $SE = 3.20$; $p = 0.0288$), cervical cancer screening ($B = -4.60$; $SE = 2.15$; $p = 0.0322$), and asthma medication management ($B = -13.74$; $SE = 3.02$; $p < 0.0001$) compared to health centers not in their first year of HCH funding.

Table 4.4. Adjusted relationships between Health Care for the Homeless (HCH) funding and quality indicators (n = 1,142 health center-years)

	BMI screening and follow-up	Cervical cancer screening	Tobacco use screening and cessation intervention	Asthma medication management	Colorectal cancer screening	Lipid therapy for coronary artery disease
	<i>B</i> (SE)	<i>B</i> (SE)	<i>B</i> (SE)	<i>B</i> (SE)	<i>B</i> (SE)	<i>B</i> (SE)
HCH funding per homeless patient	0.13 (0.36)	-0.36 (0.24)	0.09 (0.32)	0.50 (0.30)	-0.29 (0.28)	-0.30 (0.28)
Reporting Year						
2014 [Reference]						
2015	3.32 (1.09)**	-0.51 (0.90)	2.39 (1.16)*	3.08 (1.28)*	4.01 (0.93)***	0.86 (0.90)
2016	5.36 (1.36)***	-3.31 (0.90)***	4.15 (1.21)***	6.06 (1.35)***	4.29 (1.07)***	1.97 (1.01)*
2017	7.35 (1.38)***	-1.30 (0.91)	6.61 (1.22)***	5.24 (1.38)***	5.94 (1.12)***	2.62 (1.10)*
First year of HCH funding						
No [Reference]						
Yes	-7.00 (3.20)*	-4.60 (2.15)*	-4.35 (2.66)	-13.74 (3.02)***	-3.72 (2.47)	-1.88 (2.87)
Size						
Small [Reference]						
Medium	3.03 (2.19)	1.60 (1.53)	3.80 (1.63)*	1.76 (1.66)	2.54 (1.67)	3.94 (1.49)**

Large	0.50 (2.99)	3.41 (2.11)	3.80 (2.17)	1.18 (2.19)	3.25 (2.25)	4.12 (1.97)*
Setting						
Urban [Reference]						
Rural	-0.15 (1.50)	-0.11 (1.06)	1.33 (1.24)	2.41 (1.44)	-1.08 (1.17)	-0.79 (1.13)
Total revenue (USD)	144.81 (115.07)	239.66 (83.71)**	175.71 (78.60)*	90.84 (80.35)	81.38 (83.57)	1.26 (71.43)
Patient composition (%)						
Homeless	-0.03 (0.04)	-0.06 (0.03)*	0.04 (0.03)	-0.08 (0.03)*	-0.03 (0.03)	0.02 (0.03)
Non-white race	-0.05 (0.05)	0.006 (0.03)	-0.03 (0.03)	-0.005 (0.11)	-0.07 (0.04)	-0.02 (0.03)
Hispanic	0.03 (0.05)	0.12 (0.03)***	0.04 (0.04)	0.02 (0.04)	0.03 (0.04)	0.04 (0.03)
Female	-0.16 (0.15)	0.32 (0.10)**	0.12 (0.11)	-0.06 (0.11)	0.27 (0.11)*	0.02 (0.10)
Children	0.11 (0.09)	0.07 (0.06)	0.06 (0.06)	0.04 (0.06)	0.04 (0.07)	0.05 (0.06)
≥ 200% FPL	0.13 (0.12)	-0.03 (0.08)	-0.03 (0.10)	-0.11 (0.09)	-0.001 (0.10)	-0.10 (0.09)
Uninsured	0.03 (0.09)	0.04 (0.06)	-0.02 (0.07)	0.19 (0.07)**	-0.05 (0.07)	0.04 (0.06)
Medicaid	-0.03 (0.10)	0.05 (0.07)	-0.009 (0.07)	0.21 (0.07)**	-0.14 (0.08)	0.06 (0.07)
Reporting						
EHR [Reference]						
Manual chart review	-1.30 (2.56)	0.09 (1.78)	-4.13 (2.30)	5.06 (2.43)*	-2.87 (2.01)	-1.41 (2.01)

NOTES * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$. Health center size categories are based on annual patient volume: small = $\leq 8,620$ patients, medium = 8,621-24,326 patients, and large = $\geq 24,327$ patients. FPL is federal poverty level. Total revenue includes all third-party payments, grant funding, and

others source of revenue during the reporting year. All financial variables are adjusted for inflation relative to 2017. Total revenue is expressed in millions USD.

Table 4.5. Subgroup analyses for adjusted relationships between Health Care for the Homeless (HCH) funding and quality indicators among health centers in the top 25% for percent of homeless patients (n = 286 health center-years)

	BMI screening and follow-up	Cervical cancer screening	Tobacco use screening and cessation intervention	Asthma medication management	Colorectal cancer screening	Lipid therapy for coronary artery disease
	<i>B</i> (SE)	<i>B</i> (SE)	<i>B</i> (SE)	<i>B</i> (SE)	<i>B</i> (SE)	<i>B</i> (SE)
HCH funding per homeless patient	-10.61 (2.20)***	-0.01 (2.00)	1.22 (2.01)	7.26 (3.78)*	-0.09 (2.35)	-0.45 (3.35)
Reporting Year						
2014 [Reference]						
2015	2.42 (2.47)	-0.54 (1.96)	0.05 (2.75)	-0.47 (2.82)	2.90 (1.93)	-0.96 (2.18)
2016	3.57 (2.79)	-3.83 (1.84)*	3.40 (2.76)	5.54 (3.09)	1.01 (2.14)	-0.59 (2.31)
2017	3.34 (3.21)	-2.67 (1.89)	4.77 (2.37)*	3.95 (3.16)	1.29 (2.23)	0.61 (2.47)
First year of HCH funding						
No [Reference]						
Yes	-14.00 (6.02)*	-16.32 (5.80)**	-7.81 (5.69)	-28.17 (9.39)**	-15.45 (6.61)*	11.39 (9.15)
Size						
Small [Reference]						

Medium	-3.44 (3.91)	-1.40 (3.24)	3.32 (3.04)	3.25 (3.98)	-0.75 (3.50)	5.61 (3.15)
Large	-15.47 (16.38)	18.37 (10.56)	21.01 (11.81)	9.70 (13.62)	10.95 (11.13)	-3.76 (12.61)
Setting						
Urban [Reference]						
Rural	-2.06 (3.37)	-0.48 (2.89)	4.32 (3.40)	4.41 (4.88)	-5.22 (3.52)	-7.26 (3.53)*
Total revenue (USD)	-163.32 (426.48)	401.90 (322.75)	228.86 (290.22)	-400.57 (345.31)	445.35 (322.7)	-547.45 (270.11)
Patient composition (%)						
Homeless	-0.04 (0.08)	-0.06 (0.06)	0.07 (0.06)	0.01 (0.08)	-0.08 (0.07)	0.05 (0.06)
Non-white race	0.05 (0.11)	-0.09 (0.08)	0.06 (0.08)	-0.05 (0.09)	-0.12 (0.08)	-0.08 (0.07)
Hispanic	-0.29 (0.12)*	0.07 (0.09)	-0.01 (0.09)	-0.04 (0.09)	0.01 (0.09)	0.07 (0.08)
Female	-0.02 (0.27)	0.12 (0.19)	-0.19 (0.19)	-0.06 (0.22)	0.15 (0.20)	0.08 (0.18)
Children	0.08 (0.20)	0.02 (0.14)	0.17 (0.13)	0.22 (0.16)	0.18 (0.20)	0.15 (0.18)
≥ 200% FPL	0.40 (0.23)	0.33 (0.18)	0.21 (0.21)	-0.87 (0.23)***	0.51 (0.48)	-0.14 (0.49)
Uninsured	-0.04 (0.21)	0.06 (0.15)	-0.27 (0.15)	0.21 (0.20)	-0.10 (0.18)	-0.37 (0.17)*
Medicaid	-0.58 (0.23)*	-0.05 (0.17)	-0.34 (0.17)	0.18 (0.23)	-0.21 (0.21)	-0.48 (0.19)*
Reporting						
EHR [Reference]						
Manual chart review	-14.00 (6.02)	-1.91 (3.08)	-8.11 (3.63)*	3.13 (4.92)	0.12 (3.55)	3.16 (3.54)

NOTES * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$. Health center size categories are based on annual patient volume: small = $\leq 8,620$ patients, medium = 8,621-24,326 patients, and large = $\geq 24,327$ patients. FPL is federal poverty level. Total revenue includes all third-party payments, grant funding, and others source of revenue during the reporting year. All financial variables are adjusted for inflation relative to 2017. Total revenue is expressed in millions USD.

In subgroup analyses (Table 4.5) of health centers in the top 25th-percentile for percent homeless patients in a given year ($n = 286$ health center-years), HCH funding per homeless patient was negatively and significantly associated with performance on the BMI screening and follow-up quality indicator ($B = -10.61$; $SE = 2.20$; $p = <0.0001$). Conversely, HCH funding per homeless patient was significantly associated with better performance on the asthma medication management quality indicator ($B = 7.26$; $SE = 3.78$; $p = 0.0500$). Compared to 2014, performance on cervical cancer screening among this subgroup of health centers declined significantly in 2016 ($B = -3.83$; $SE = 1.84$; $p = 0.0389$), while rates of tobacco use screening and cessation intervention improved in 2017 ($B = 4.77$; $SE = 2.37$; $p = 0.0454$). In addition, being in the first year of HCH funding was negatively associated with performance on BMI screening and follow-up ($B = -14.00$; $SE = 6.02$; $p = 0.0209$), cervical cancer screening ($B = -16.32$; $SE = 5.80$; $p = 0.0054$), asthma medication management ($B = -28.17$; $SE = 9.39$; $p = 0.0030$), and colorectal cancer screening ($B = -15.45$; $SE = 6.61$; $p = 0.0204$).

Among this subgroup of health centers with a high proportion of homeless patients, a higher percentage of Hispanic patients was associated with worse performance on BMI screening and follow-up ($B = -0.29$; $SE = 0.12$; $p = 0.0228$), while a greater percentage of patients with incomes $\geq 200\%$ FPL was associated with worse performance on asthma medication management ($B = -0.87$; $SE = 0.23$; $p = 0.0002$). A health center's percentage of uninsured patients was negatively associated with performance on lipid therapy for coronary artery disease ($B = -0.37$; $SE = 0.17$; $p = 0.0281$) and percent of Medicaid patients was associated with worse performance on both lipid therapy ($B = -0.48$; $SE = 0.19$; $p = 0.0137$) and BMI screening and follow-up ($B = -0.58$; $SE = 0.23$; $p =$

0.0126). Finally, rural health centers demonstrated reduced performance on lipid therapy for coronary artery disease ($B = -7.26$; $SE = 3.53$; $p = 0.0408$).

Discussion

In the present study, HCH funding per homeless patient was not significantly associated with performance on any of the six clinical quality indicators among HCH-funded health centers. However, in subgroup analyses of HCH-funded health centers with a high proportion of homeless patients, HCH funding per homeless patient was associated with an increase of 7.3 percent in patients aged 5-64 years with persistent asthma who were appropriately prescribed medication. In this same subgroup, HCH funding per homeless patient was also associated with significantly worse performance on the BMI screening and follow-up quality indicator. These mixed findings raise several avenues for further research.

First, for the main analysis performed on the full sample of all HCH-funded health centers, there are several potential explanations for findings of a null relationship between HCH funding per homeless patient and the clinical quality indicators assessed in this study. Although each of the 298 HCH-funded health centers in the full sample had a nonzero number of homeless patients for all years of the study, the proportion of all health center patients who were identified as homeless was quite variable across health centers and from year to year. Some health centers reported a percentage of homeless patients as low as 1%, while others featured a patient population that was exclusively homeless. Among health centers that received HCH funding but had a low proportion of patients who experience homelessness, any changes in clinical quality attributable to

HCH funding among this small subset of homeless patients is likely insufficient to effect a measurable change in clinical quality measures, which are reported at the health center-level for all patients served. This rationale is supported by the significant associations between HCH funding per homeless patient and some clinical quality indicators uncovered in subgroup analyses of HCH-funded health centers with high proportions of homeless patients. Compounding the difficulties in detecting HCH funding effects is the fact that patient data are reported to the UDS in aggregate at the health center level, and therefore do not allow us to isolate performance on quality indicators among specific subgroups, such as homeless patients. Again, HCH-associated effects among homeless patients on any of the six clinical outcomes evaluated in this study are likely to have been subsumed by trends among the larger health center population of non-homeless patients.

Another explanation for the lack of association found between HCH funding and clinical quality indicators in this study may be that it is beyond the scope of these data to establish a relationship between grant funding and health-related outcomes— even the process-level health measures, including preventive screenings or receipt of medication management, chosen as outcomes for the present analyses. Several studies have previously established the importance of grant funding in increasing health center capacity, a more proximal outcome and arguably one more sensitive to change than any measures of health utilization, behaviors, or status. For instance, Lo Sasso et al. (2010), using several years of UDS data, found that each additional \$1 million dollars in federal grant support translated to a given health center’s ability to hire eight additional full-time-equivalent employees (Lo Sasso & Byck, 2010). Notably, in this study, HCH-funded health centers in their first year of HCH funding exhibited worse performance for several

quality indicators compared to health centers not in their first year of HCH funding. Although staffing variables were not evaluated in these analyses, this finding may be a result of capacity growth during the first year of HCH funding that becomes manifest in subsequent years of funding once additional staff has been hired. Future work could explore the relationship between HCH funding and measures of organizational capacity and performance among HCH-funded health centers.

In this study, subgroup analyses among the subset of HCH-funded health centers with a high proportion of homeless patients indicated a positive association between HCH funding per homeless patient and rates of asthma medication management among patients aged 5-64 years. One explanation for this finding may be the inclusion of children in this measure. Since children and adolescents under 18 years of age typically qualify for more avenues to health insurance coverage than adults through state Medicaid programs and the Children's Health Insurance Program (CHIP), the compensation provided for asthma treatment may free up HCH dollars to spend on uninsured homeless adults with asthma. Unfortunately, limitations in the data available prevent formal testing of this hypothesis.

Conversely, among HCH-funded health centers with high proportions of homeless patients, HCH funding per homeless patient was associated with worse performance on BMI screening and follow-up. It may be that weight management is not viewed as a priority in this population, given the presumption that, since people who experience homelessness are likely to experience food insecurity, they are also likely to be underweight. However, a growing body of empirical evidence supports the so-called "food insecurity-obesity paradox," by which individuals with scarce resources are more

likely to purchase and consume low-cost, high-calorie foods out of budgetary constraints and/or a lack of capacity to prepare meals at home (Dinour, Bergen, & Yeh, 2007; Townsend, Peerson, Love, Achterberg, & Murphy, 2001). Indeed, it has been estimated that between 57-68.4% of homeless adults are overweight or obese (Martins et al., 2015; Tsai & Rosenheck, 2013). Importantly, overweight and obesity are well-evidenced predisposing factors for many chronic diseases that are prevalent among homeless adults, including hypertension, diabetes, and heart disease (Baggett et al., 2013; Bernstein et al., 2015). Providers who work with homeless patients should take care not to ignore the role of BMI monitoring and weight management strategies in treatment plans in this population.

Beyond challenges in accurately evaluating the relationship between HCH grant funding and clinical quality, HCH-funded health centers may begin to experience changes in revenue and performance in the context of evolving Medicaid expansion in many states as well as other activities associated with the Affordable Care Act (ACA). Although grant funding (including HCH dollars) accounts for approximately one-fifth of total federally qualified health center revenue each year (Doty, Abrams, Hernandez, Stremikis, & Beal, 2010), the largest single source of health center revenue has historically been Medicaid reimbursement, which contributes approximately 35% of health center net revenue annually (Doty et al., 2010). Early evidence on the impact of Medicaid expansion on federally qualified health centers suggests that patients served by HCH-funded health centers in expansion states have gained insurance at a pace far exceeding those in non-expansion states (DiPietro et al., 2014) and that Medicaid

expansion has resulted in significant revenue gains for HCH-funded programs in expansion states (Warfield, DiPietro, & Artiga, 2016).

As Medicaid expansion continues to unfold and other ACA-driven efforts to increase rates of health insurance coverage among low-income Americans proceed, it is important to evaluate any effects on health center service provision and quality. There is some empirical evidence that health centers with a higher proportion of revenue from insurance payments than from grants operate more efficiently (Amico, Chilingirian, & Van Hasselt, 2014). In addition, Medicaid expansion has already been associated with improvements in both health center capacity (Han, Luo, & Ku, 2017) and quality measures (Cole, Galárraga, Wilson, Wright, & Trivedi, 2017) within the broader universe of community health centers. Gains in Medicaid coverage for many previously ineligible homeless patients has the potential to expand HCH program capacity by increasing third-party revenue, freeing up grant funds to strengthen or broaden the range of services available for homeless patients, especially those services not reimbursed by Medicaid (DiPietro, Knopf, Artiga, & Arguello, 2012). Future research on the HCH system of care should explore how changes to the reimbursement environment impact quality of care delivered. Again, though, any improvements in overall clinical quality demonstrated in the wake of Medicaid expansion among HCH-funded health centers may mask effects among the subset of homeless patients at these health centers, who-- despite representing their target population-- comprise a minority of patients in most HCH-funded health centers.

In addition, a handful of recent studies have indicated a potential cause for concern that Medicaid uptake in expansion states has been lower-than-desired among

homeless adults by documenting barriers to enrollment and retention in coverage. For example, homeless persons may have a poor general awareness of the ACA, lack understanding of the eligibility criteria, and perceive limited means by which to enroll (Donley & Wright, 2018; Fryling, Mazanec, & Rodriguez, 2015; Tsai, Rosenheck, Culhane, & Artiga, 2013). Additionally, providers serving homeless populations have reported many homeless adults as disengaged from and distrustful of public systems and facing multiple barriers to Medicaid enrollment, including language and literacy barriers and lack of stable contact information and documentation (DiPietro et al., 2012). Furthermore, inappropriate disenrollment is a problem for homeless beneficiaries, who do not receive redetermination notices, have difficulty providing required documentation to confirm continued eligibility, and/or lose benefits in violation of their due process rights (Post, 2001). However, current limitations to the granularity of available UDS data prevent analysis of Medicaid uptake specifically among homeless health center patients.

Encouragingly, performance on several clinical quality indicators among HCH-funded health centers in this study was found to be equal to or slightly better than those identified in past studies among the broader universe of community health centers (inclusive of HCH-funded health centers). At 81.4%, HCH-funded health centers in this analysis appear to perform similarly on measures of asthma medication management, identified in previous studies to be between 79.1-84.6% (Cole et al., 2017); lipid therapy for coronary artery disease (77.8% in the present study, 77.7-78.5% in previous work) (Cole et al., 2017); colorectal cancer screening (31.4% in this study, 33.4-32.9% in previous studies) (Cole et al., 2017); and BMI screening and follow-up (58.4% in the present study, 54.7-57.1% in previous work) (Cole et al., 2017). Only on cervical cancer

screening performance did HCH-funded health centers demonstrate an average performance (47.6%) worse than that previously found among the larger sample of all federally qualified health centers (51.4-48.5%) (Cole et al., 2017; Shi et al., 2012). This discrepancy in cervical cancer screening may partially be explained by the predominance of men among homeless individuals in the United States (Henry et al., 2017), and, indeed, in the present study a higher health center proportion of female patients was significantly associated with better performance on this measure among HCH-funded health centers.

In addition to those already discussed, there are several limitations of this study. First, measurement of HCH funding and reporting on patient and organizational characteristics is aggregated by HRSA at the grantee or parent organizational level, preventing us from exploring potential differences in outcomes between individual health center delivery sites. Next, as already discussed, it is not possible from publicly available UDS data to isolate quality outcomes specifically for subsets of patients identified as homeless. Only data for the proportion of all patients who are homeless are available per grantee, per year. Although HCH-funded federally qualified health centers serve more than three-quarters of all homeless patients that visit any community health center each year (Swofford, 2011), this represents a serious limitation in the ability of this or any study to isolate changes in quality among homeless patients specifically. Finally, analyses were limited by the availability of certain data elements. It was not possible to include variables not collected in the UDS or that featured a high proportion of missing data elements. For example, percent of patients who are migrant or seasonal farmworkers has previously been inversely associated with health center quality performance (Hu, Shi,

Lee, & Haile, 2016; Hu et al., 2018; Shi et al., 2012), but there was a high proportion of missing data for these variables among HCH-funded health centers and they were not included in final model specifications.

Despite the importance of the Health Care for the Homeless program as the sole federally funded, dedicated system of primary care for individuals and families experiencing homelessness, this study is the first to evaluate clinical quality performance among HCH-funded health centers at a national scale. As the status of federal grant funding for health and social services initiatives is perpetually in flux, it is important to understand the impact of grant funding on the capacity for safety-net clinics to provide effective, quality care to the most vulnerable members of society.

CHAPTER 5: CONCLUSIONS

Collectively, the three studies in this dissertation sought to answer timely health policy and management questions about individuals who experience housing needs in the United States. Chapter 2 describes a systematic review of the peer-reviewed literature on interventions to reduce emergency department use among adults experiencing homelessness. In the context of increasing attention to and incentives for addressing health-related social needs among vulnerable patients, this review of interventions to reduce emergency department use among homeless patients touches on a timely and important concern in modern health care delivery. In addition, because of the high cost burden of excessive emergency department use, health systems and policymakers continue to desire evidence in order to effectively intervene among high-utilizing individuals in a manner that is both pragmatic and ethical. In this review, no single intervention type emerged as being clearly superior over others in reducing emergency department use among homeless participants, highlighting the mixed state of research on how best to address this challenge. However, the findings of this systematic review will help guide future research to develop, refine, and test existing and new interventions seeking to reduce emergency department use among homeless patients. Namely, the knowledge base in this area would be significantly strengthened by studies that are both stronger in internal validity and generalizable to more different subgroups of individuals and families who experience homelessness (e.g., women, people living in rural communities).

Health insurance coverage has shown to be protective against health-related financial shocks, which may precipitate homelessness among individuals and families

who are already economically insecure. With the passage of the Affordable Care Act (ACA) in 2010, the widespread expansion of Medicaid eligibility requirements in many states provided new insurance options for previously ineligible vulnerable populations, including many adults at risk of homelessness. Chapter 3 recounts the results of an analysis to examine the impact of Medicaid expansion on overall rates of homelessness and on the following sub-groups: single adults, adults in families with children, veterans, and adults who experience chronic homelessness. Among individuals living in a family with children, a modest but statistically significant decrease in homelessness attributable to Medicaid expansion was observed, amounting to a statistically significant reduction of 0.64 per 10,000 residents of expansion states. The results of this study suggest that expanding Medicaid eligibility improves access to health insurance coverage for adults with children who may be vulnerable to homelessness and mitigates the impact of large or unexpected medical expenses that contribute to homelessness among families. In addition, the impact of health insurance on the financial stability of adults with children may be magnified relative to individuals not living in families, given that families tend to incur more medical expenses and have greater overall household costs than single adults. Although further investigation is needed, these findings provide new evidence for policymakers as they consider the role of state Medicaid programs in addressing the health-related social needs of at-risk individuals and families.

Finally, Chapter 4 of this dissertation sought to identify determinants of and trends in clinical quality performance among federally qualified health centers that receive Health Care for the Homeless (HCH) funding to provide tailored care and social services to patients who experience homelessness. Although HCH funding per homeless

patient was not significantly associated with performance on any of the six clinical quality indicators among HCH-funded health centers, several distinct organizational characteristics were identified as factors that influenced performance on several quality measures. In subgroup analyses of HCH-funded health centers with a high proportion of homeless patients, HCH funding per homeless patient was negatively and significantly associated with weight screening and follow-up, but significantly associated with better performance on the quality indicator for asthma medication management.

Although each study was meant to address different facets of the relationship between homelessness and the United States health care delivery system, all highlight significant limitations in our current ability to measure and study homelessness at a national scale. As demonstrated in Chapter 3, the sole federal census of homelessness in the United States has serious weaknesses that greatly hinder its utility in research and practice, even though decisions related to federal policy and funding priorities rely on these data. Additionally, despite the influence of homelessness on health status, patient housing status is not routinely documented in health care delivery settings, and people who are homeless are typically excluded from important household surveys to assess population health. Within individual health systems, efforts to capture data on patient homelessness have demonstrated the feasibility and challenges of measuring this social determinant of health at an organizational level (Byrne et al., 2015; Montgomery, Fargo, Kane, & Culhane, 2014). In many cases, the ability of researchers to deliver high-quality evidence that generalizes across settings can only extend as far as available data. An important avenue for continued research and advocacy in this area must involve expanding the scope and quality of existing surveillance systems on housing needs and

homelessness, with the ultimate aim of improving access to and quality of health care services among the considerable swatch of Americans who experience housing instability or homelessness.

APPENDICES

Appendix A: Systematic review search protocol by database

MEDLINE

Homeless	exp HOMELESS PERSONS/ OR homeless*.mp OR “street people”.mp OR “street person”.mp OR vagrant.mp or unsheltered OR “unstably housed”
Utilization	exp HOSPITALIZATION/ OR hospitalization.mp OR exp Patient Readmission/ OR “patient readmission”.mp OR Emergency Service, Hospital/ OR “emergency department”.mp OR “emergency room”.mp
Limits	English language, has abstract, 1980-2018

Embase

Homeless	'homeless person'/exp
Utilization	'hospitalization'/exp OR 'emergency treatment'/exp
Limits	English language, has abstract, 1980-2018

PsychINFO

Homeless	(homeless or homelessness or unsheltered or "unstably housed" or "street people" or "street person" or vagrant)
Utilization	(hospitalization or hospitalized or inpatient or readmission or "emergency department" or "emergency room")
Limits	English language, has abstract, peer-review, 1980-2018

CINAHL

Homeless	(homeless or homelessness or unsheltered or "unstably housed" or "street people" or "street person" or vagrant)
Utilization	(hospitalization or hospitalized or inpatient or readmission or "emergency department" or "emergency room")
Limits	English language, has abstract, peer-review, 1980-2018

Web of Science SCI

Homeless	TS=homeless* or TS=homeless person or TS=unsheltered or TS=street people or TS=street person or TS=vagrant or TS=unstably housed
Utilization	TS=hospitalization or TS=hospitalized or TS=inpatient or TS=readmission or TS=emergency department or TS=emergency room
Limits	English language, document type=article, timespan= all years(1985-2018)

Appendix B: Cochrane Handbook study design classifications, descriptions, risk of bias rating, and included studies from review

Risk of bias rating	Design	Description
Low	Randomized controlled trial (RCT)	An experimental study in which participants are prospectively allocated to different interventions using methods that are random.
Low	Non-randomized controlled trial (NRCT)	An experimental study in which participants are prospectively allocated to different interventions using methods that are not random.
High	Controlled before-and-after study (CBA)	A study in which observations are made before and after the implementation of an intervention, both in a group that receives the intervention and in a control group that does not. Decisions about allocation to the different comparison groups are not made by the investigators.
High	Cohort study (CS)	A study in which a defined group of people (the cohort) is followed over time, to examine associations between different interventions received and subsequent outcomes.
High	Before-and-after comparison (BA)	A study in which observations are made before and after the implementation of an intervention in a single intervention group.

SOURCE Green, S. & Higgins, J.P. (Eds.). (2008). *Cochrane handbook for systematic reviews of interventions*. Chichester, UK: John Wiley & Sons.

Appendix C: Records derived from the same study, status, and rationale for inclusion or exclusion

Study: At Home/Chez Soi trial

Citation	Status	Rationale
Aubry T, Nelson G, Tsemberis S. A multiple-city RCT of Housing First with assertive community treatment for homeless Canadians with serious mental illness. <i>Psych Serv</i> . 2016;67:275-81.	Included	Primary results for At Home/Chez Soi study for all five study sites
Kerman N, Sylvestre J, Aubry T, Distasio J. The effects of housing stability on service use among homeless adults with mental illness in a randomized controlled trial of Housing First. <i>BMC Health Serv Res</i> . 2018;18(1):190.	Excluded	Analysis of subgroups stratified by degree of housing stability
Pakzad S, Bourque PÉ, Bourque J, Aubry T, Gallant L, LeBlanc SR, Tivendell J. A comparison of the use of physical and mental health services by homeless people with severe mental health problems in the Moncton area through the At Home/Chez Soi program. <i>Can J Commun Ment Health</i> . 2017;36(Special Issue):77-105.	Excluded	Moncton site only
Stergiopoulos V, Gozdzik A, Misir V, et al. Effectiveness of housing first with intensive case management in an ethnically diverse sample of homeless adults with mental illness: A randomized controlled trial. <i>PLoS One</i> . 2015;10(7):e0130281.	Excluded	Toronto site only

Study: Chicago Housing for Health Partnership

Citation	Status	Rationale
Basu A, Kee R, Buchanan D, Sadowski LS. Comparative cost analysis of housing and case management program for chronically ill homeless adults compared to usual care. <i>Health Serv Res</i> . 2012;47(1pt2):523-543.	Excluded	Focus on cost effectiveness of intervention
Sadowski LS, Kee RA, VanderWeele TJ, Buchanan D. Effect of a housing and case management program on emergency department visits and hospitalizations among chronically ill homeless adults: A randomized	Included	Primary results of Chicago Housing for Health Partnership program

trial. <i>JAMA</i> . 2009;301(17):1771-1778.		
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Study: HUD-CDC Housing and Health Study

Citation	Status	Rationale
Holtgrave DR, Wolitski RJ, Pals SL. Cost-utility analysis of the housing and health intervention for homeless and unstably housed persons living with HIV. <i>AIDS Behav</i> . 2013;17(5):1626-1631.	Excluded	Focus on cost utility of intervention
Wolitski RJ, Kidder DP, Pals SL. Randomized trial of the effects of housing assistance on the health and risk behaviors of homeless and unstably housed people living with HIV. <i>AIDS Behav</i> . 2010;14(3):493-503.	Included	Primary results of Housing and Health Study

Study: VA HUD-VASH Homeless Patient Aligned Care Team (H-PACT) program

Citation	Status	Rationale
Gundlapalli AV, Redd A, Bolton D, et al. Patient-aligned care team engagement to connect veterans experiencing homelessness with appropriate health care. <i>Med Care</i> . 2017;55:S104-S110.	Included	Reports on all participants nationwide
O'Toole TP, Johnson EE, Borgia M, Noack A, Yoon J, Gehlert E, Lo J. Population-tailored care for homeless veterans and acute care use, cost, and satisfaction: A prospective quasi-experimental trial. <i>Prev Chronic Disease</i> . 2018;15:E23-E23.	Excluded	Subset of participants from full study
O'Toole TP, Johnson EE, Aiello R, Kane V, Pape L. Tailoring care to vulnerable populations by incorporating social determinants of health: The Veterans Health Administration's "Homeless Patient Aligned Care Team" program. <i>Prev Chronic Disease</i> . 2016;13:E44-E44.	Excluded	Subset of participants from full study
O'Toole TP, Buckel L, Bourgault C, et al. Applying the chronic care model to homeless veterans: Effect of a population approach to primary care on utilization and clinical outcomes. <i>Am J Public Health</i> . 2010;100(12):2493-2499.	Excluded	Providence, RI VA site only

Study: Assertive community treatment (ACT) adaptation trial for homeless adults

Citation	Status	Rationale
Lehman AF, Dixon L, Hoch JS, et al. Cost-effectiveness of assertive community treatment for homeless persons with severe mental illness. <i>Br J Psychiatry</i> . 1999;174(4):346-52.	Excluded	Cost-effectiveness analysis only
Lehman AF, Dixon LB, Kernan E, et al. A randomized trial of assertive community treatment for homeless persons with severe mental illness. <i>Arch Gen Psychiatry</i> . 1997;54(11):1038-1043.	Included	Primary study results

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- Zewde, N., & Wimer, C. (2019). Antipoverty impact Of Medicaid growing with state expansions over time. *Health Affairs*, 38(1), 132-138.
- Zhong, Y., Auchincloss, A. H., Lee, B. K., & Kanter, G. P. (2018). The short-term impacts of the Philadelphia beverage tax on beverage consumption. *American Journal of Preventive Medicine*, 55(1), 26-34.
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CURRICULUM VITAE

Elizabeth H. Golembiewski

EDUCATION

Institution and Location	Degree	Date	Field of Study
Indiana University Richard M. Fairbanks School of Public Health <i>Indianapolis, IN</i>	PhD	08/2019	Health Policy and Management Minor: Sociology
University of Iowa College of Public Health <i>Iowa City, IA</i>	MPH	05/2014	Community and Behavioral Health Subtrack: Health Communication
University of Iowa <i>Iowa City, IA</i>	BA	05/2011	English Literature (with Honors) Minors: Chemistry, Latin

ACADEMIC EMPLOYMENT

Dates	Position	Institution	Location
2015-2019	Graduate Research Assistant	Indiana University Fairbanks School of Public Health, Department of Health Policy and Management	Indianapolis, IN
2013-2015	Research Assistant	University of Iowa Public Policy Center	Iowa City, IA
2013-2014	Administrative Intern	Shelter House, Fairweather Lodge Permanent Supportive Housing program	Iowa City, IA

2013-2013	Intern	Iowa Department of Public Health, Bureau of Nutrition and Physical Activity	Des Moines, IA
2013-2014	Graduate Research Assistant	University of Iowa College of Public Health, Department of Community and Behavioral Health	Iowa City, IA
2012-2013	Health Records Assistant	University of Iowa College of Public Health, Department of Community and Behavioral Health, Center for Health Communication and Social Marketing	Iowa City, IA

PEER-REVIEWED PUBLICATIONS

1. Harle, C., **Golembiewski, E.**, Rahmanian, K., Brumback, B., Krieger, J., Goodman, K., Mainous, A., & Moseley, R. (2019). Does an interactive trust-enhanced electronic consent improve patient experiences when asked to share their health record for research? A randomized trial. *Journal of the American Medical Informatics Association*. [In press].
2. Askelson, N., **Golembiewski, E.**, Meier, C., Smith, R., Montgomery, D., Lillehoj, C., & Wilson, S. (2019). Out of the mouths of babes: Pester power: Understanding parent-child communication about fruits and vegetables in low-income families from the child's perspective. [In press].
3. Jackson, J.R., Holmes, A.M., **Golembiewski, E.**, Brown-Podgorski, B.L., & Menachemi, N. (2019). Minority doctoral recipients in public health disciplines: Graduation and academic placement trends 2003-2015. *Public Health Reports*, 134(1), 63-71.
4. Brown-Podgorski, B., Holmes, A., Jackson, J., **Golembiewski, E.**, & Menachemi, N. (2018). Employment trends among doctoral recipients in public health disciplines (2003-2015). *American Journal of Public Health*, 108, 1171-1177.
5. **Golembiewski, E.**, Jackson, J., Brown-Podgorski, B., & Menachemi, N. (2018). Interdisciplinary dissertation research among public health doctoral trainees, 2003-2015. *Public Health Reports*, 133(2), 182-190.

6. Harle, C.A., **Golembiewski, E.**, Rahmanian, K.P., Krieger, J.L., Hagmajer, D., Mainous, A.G., & Moseley, R.E. (2017). Patient preferences toward an interactive e-consent application for research using electronic health records. *Journal of the American Medical Informatics Association*, 25(3), 360-368.
7. **Golembiewski, E.**, Watson, D., Robison, L., & Coberg, J.W. (2017). Social network decay as potential recovery from homelessness: A mixed methods study in Housing First programming. *Social Sciences*, 6(3), 96.
8. Hood, S., **Golembiewski, E.**, Benbow, K., Sow, H., & Sanders, V. (2017). Who can I turn to? Emotional support availability in African American social networks. *Social Sciences*, 6(3), 104.
9. Watson, D., Shuman, V., Kowalsky, J., **Golembiewski, E.**, & Brown, M. (2017). Housing First and harm reduction: A rapid review and document analysis of the U.S. and Canadian open-access literature. *Harm Reduction Journal*, 14(1), 30.
10. Askelson, N. M., **Golembiewski, E.**, Baquero, B., Momany, E. T., Friberg, J., & Montgomery, D. (2017). The importance of matching the evaluation population to the intervention population: Using Medicaid data to reach hard-to-reach intervention populations. *Evaluation and Program Planning*, 60, 64-71.
11. Jackson, J. R., Jennings, J., **Golembiewski, E.**, Brown-Podgorski, B. L., & Menachemi, N. (2017). Black graduates of health administration doctoral programs: Examining trends. *Journal of Health Administration Education*, 34(2), 213-227.
12. Askelson, N. M., **Golembiewski, E.**, Ghattas, A., Williams, S., Delger, P. J., & Scheidel, C. A. (2017). Exploring parents' attitudes and perceptions about school breakfast to understand why participation is low in a rural midwest state. *Journal of Nutrition Education and Behavior*, 49(2), 107-116.
13. Askelson, N. M., **Golembiewski, E.**, Bobst, A., Delger, P. J., & Scheidel, C. A. (2017). Understanding perceptions of school administrators related to school breakfast in a low school breakfast participation state. *Journal of School Health*, 87(6), 427-434.
14. Askelson, N., Cornish, D. L., & **Golembiewski, E.** (2016). Rural school food service director perceptions on voluntary school meal reforms. *Journal of Agriculture, Food Systems, and Community Development*, 6(1), 65-75.

15. Cornish, D., Askelson, N., & **Golembiewski, E.** (2016). "Reforms looked really good on paper": Rural food service responses to the Healthy, Hunger-Free Kids Act of 2010. *Journal of School Health*, 86(2), 113-120.
16. Askelson, N., **Golembiewski, E.**, DePriest, A., O'Neill, P., Delger, P. J., & Scheidel, C. A. (2015). The answer isn't always a poster: Using social marketing principles and concept mapping with high school students to improve participation in school breakfast. *Social Marketing Quarterly*, 21(3), 119-134.
17. **Golembiewski, E.**, Askelson, N., Elchert, D., Leicht, E., Scheidel, C., & Delger, P. (2015). From policy to practice: Parent perceptions of the 2010 federal school lunch mandate. *Journal of Child Nutrition and Management*, 39(1).
18. Cornish, D., Askelson, N., & **Golembiewski, E.** (2015). Professional networks among rural food service directors implementing the Healthy, Hunger-Free Kids Act. *Journal of Child Nutrition and Management*, 39(1).

WORKS IN PROGRESS

1. Askelson, N., Lillehoj, C., **Golembiewski, E.**, Budzyn, S., Montgomery, D., & Wilson, S. (2018). The role of nutrition educators in school-based nutrition and physical activity policy, systems and environmental changes: A qualitative assessment. *Public Health Nutrition*. [Under review].
2. **Golembiewski, E.**, Allen, K., Blackmon, A., Hinrichs, R., & Vest, J. (2018). Combining social determinants of health and clinical data for research and evaluation: A rapid review. *BMC Medical Informatics and Decision Making*. [Under review].
3. Hood, S., **Golembiewski, E.**, Sow, H., Benbow, K., Prather, J., Robison, L., & Martin, E. (2018). Structural and contextual patterns in family health history knowledge among African-American adults: A mixed-methods social network analysis study. *Journal of Social Structure*. [Under review].
4. Askelson, N., Lillehoj, C., **Golembiewski, E.**, Budzyn, S., Montgomery, D., & Wilson, S. (2018). The role of nutrition educators in school-based nutrition and physical activity policy, systems and environmental changes: A qualitative assessment. [Under review].
5. Vest, J.R., **Golembiewski, E.**, Hilts, K.E., Skopelja, E., Hainline, B., & Menachemi, N. (2016). Effects of physical conditioning on the performance, health, and well-

being of elite athletes: A systematic review. *BMC Sports Science, Medicine and Rehabilitation*. [Under review].

TECHNICAL REPORTS AND WHITE PAPERS

1. Watson, D., Robison, L., **Golembiewski, E.**, & Coberg, J. (2017). Evaluation of the Penn Place permanent supportive housing program: Summative report. [Evaluation report]. Indianapolis, IN: Community Health Engagement & Equity Research (CHEER), Indiana University-Purdue University Indianapolis.
2. **Golembiewski, E.** & Watson, D. (2016). Peer Empowerment Effects Recovery Services (PEERS): Summary of evaluation activities, Year 2. [Evaluation Report]. Indianapolis, IN: Center for Health Policy, Indiana University-Purdue University Indianapolis.
3. **Golembiewski, E.** & Watson, D. (2016). Penn Place evaluation: Baseline resident data. [Evaluation Report]. Indianapolis, IN: Center for Health Policy, Indiana University-Purdue University Indianapolis.
4. Kooremann, H., Kouns, L., Greene, M., Watson, D. P., & **Golembiewski, E.** (2015). Substance use among young adults in Indiana who are not enrolled in college. [Study Report]. Indianapolis, IN: Center for Health Policy, Indiana University-Purdue University Indianapolis.
5. **Golembiewski, E.**, Askelson, N. M., Bentler, S. E., Damiano, P. C., & Momany, E. T. (2015). Evaluation of the Integrated Health Home (IHH) program in Iowa: Qualitative interviews with site administrators. [Evaluation Report]. Iowa City, IA: University of Iowa Public Policy Center.
6. Askelson, N. M., **Golembiewski, E. H.**, & DePriest, A. M. (2015). Administrator school breakfast survey: Report of findings. [Study Report]. Iowa City, IA: University of Iowa Public Policy Center.
7. Askelson, N.M., **Golembiewski, E.**, DePriest, A., & Williams, S. (2015). Parent school breakfast survey: Report of findings. [Study Report]. Iowa City, IA: University of Iowa Public Policy Center.
8. Askelson, N. M., **Golembiewski, E.**, Ortiz, C., & Williams, S. (2015). Evaluation of the Personal Responsibility Education Program (PREP) in Iowa: Focus groups with participants. [Evaluation Report]. Iowa City, IA: University of Iowa Public Policy Center.

9. Askelson, N. M., & **Golembiewski, E.** (2014). Interviews with Pick a better snack contractors about policy, system, and environmental change: Report to Iowa Department of Public Health. [Evaluation Report]. Iowa City, IA: University of Iowa College of Public Health, Center for Health Communication and Social Marketing.
10. Askelson, N., Bentler, S., Momany, E., **Golembiewski, E.**, & Damiano, P. (2014). Iowa Medicaid Health Home Providers: A qualitative examination of the implementation of the Iowa Medicaid Health Home. [Evaluation Report]. Iowa City, IA: University of Iowa Public Policy Center.
11. Askelson, N. M., Baquero, B., **Golembiewski, E.**, Heath, M., & Friberg, J. (2014). A qualitative investigation of parent-child communication about fruits and vegetables in the context of a classroom-based intervention: Report to the Iowa Department of Public Health. [White Paper]. Iowa City, IA: University of Iowa College of Public Health, Center for Health Communication and Social Marketing.
12. Askelson, N. M., Bentler, S., Momany, E., & **Golembiewski, E.** (2014). The implementation of Iowa Medicaid Health Homes from the perspective of the clinic. Report to Iowa Department of Human Services. [Evaluation Report]. Iowa City, IA: University of Iowa Public Policy Center.
13. Askelson, N. M., **Golembiewski, E.**, Tegene, M. A., DePriest, A. M., & Shultz, H. M. (2014). IowaCare: Examining the implementation of the IowaCare program in Federally Qualified Health Centers. [Evaluation Report]. Iowa City, IA: University of Iowa Public Policy Center.
14. Askelson, N. M., Baquero, B., **Golembiewski, E.**, DePriest, A., & Momany, E. (2014). Examining parent-child communication about fruits and vegetables in the context of a classroom-based intervention: Report to Iowa Department of Public Health. Iowa City, IA: University of Iowa College of Public Health, Center for Health Communication and Social Marketing.
15. Askelson, N., Turchi, J., Elchert, D., **Golembiewski, E.**, Leicht, E., & Rasmusson, A. (2014). Say what?! Sexual health: Adolescent social network characteristics and communication patterns. University of Minnesota School of Public Health, *Healthy Generations*, pp. 23-25.

16. Askelson, N. M., **Golembiewski, E.**, DePriest, A. M., O'Neill, P., Delger, P., Scheidel, C. & students at Waukee High School, Pleasant Valley High School, & Cedar Rapids Jefferson High School. (2014). Ways to make school breakfast the easy and healthy choice: Responding to the students. Report to Iowa Department of Education. Iowa City, IA: University of Iowa Public Policy Center.
17. Askelson, N., **Golembiewski, E.**, & Elchert, D. (2013). Focus group report for Iowa Department of Public Health SNAP-Ed evaluation. [Evaluation Report]. Iowa City, IA: University of Iowa College of Public Health, Center for Health Communication and Social Marketing.
18. Askelson, N., **Golembiewski, E.**, & Elchert, D. (2013). Iowa parent school lunch survey: Formative research for communication about school meal pattern changes. [Evaluation Report]. Iowa City, IA: University of Iowa College of Public Health, Center for Health Communication and Social Marketing.
19. Askelson, N., **Golembiewski, E.**, Turchi, J., Elchert, D., & Tegegne, M. (2013). Evaluation of Iowa's Children's Health Insurance Program Reauthorization Act (CHIPRA) outreach and enrollment project. [Evaluation Report]. Iowa City, IA: University of Iowa Public Policy Center.

CONFERENCE PRESENTATIONS

**Indicates presenting author*

Golembiewski, E.* & Harle, C. "Creating a lexicon to support identifying patients with homelessness through natural language processing of clinical notes." AcademyHealth Annual Research Meeting. Seattle, WA, June 2018. [Poster presentation].

Hood, S., **Golembiewski, E.**, Sow, H., Benbow, K., Prather, J., Robison, L., & Martin, E. "An exploration of structural and contextual patterns in family health history knowledge among African American adults." 39th Annual Meeting and Scientific Sessions of the Society of Behavioral Medicine. New Orleans, LA, April 2018. [Oral presentation].

Hood, S., **Golembiewski, E.**, Sow, H., Benbow, K., Prather, J., Robison, L., & Martin, E. "The African-American Family Health Communication Project: A social network analysis of factors influencing family health history information exchanges." American Public Health Association, Society for African-American Public Health Issues Pre-conference Symposium. Atlanta, GA, November 2017. [Oral presentation].

Golembiewski, E.*, Askelson, N., Momany, E., Bentler, S., & Smith, R. "Administrative perspectives on barriers to integrating primary care and mental health services in community-based settings: A qualitative evaluation of Iowa's Integrated Health Home demonstration program." American Public Health Association Annual Meeting. Denver, CO, October-November 2016. [Oral presentation].

Askelson, N., **Golembiewski, E.**, Meier, C., Smith, R., Wilson, S., Lillehoj, C., & Montgomery, D. "‘Please! Please get me the carrots!’: A qualitative examination of parent-child communication about fruits and vegetables from the child's perspective." American Public Health Association Annual Meeting. Denver, CO, October-November 2016. [Poster presentation].

Askelson, N., **Golembiewski, E.**, Scheidel, C., & Delger, P. "Understanding low breakfast participation in the Heartland: Are Midwest values competing with school breakfast participation?" American Public Health Association Annual Meeting. Chicago, IL, November 2015. [Poster presentation].

Golembiewski, E., Askelson, N. M., Montgomery, D., & Baquero, B.. "I love when they ask me for fruit or veggies, especially if they consider that a dessert: Examining parent-child communication about fruits and vegetables." Iowa Public Health Association Annual Meeting. Cedar Rapids, IA, April 2015. [Oral presentation].

Askelson, N. M., Lubker-Cornish, D., & **Golembiewski, E.** "Exploring the Health, Hunger-Free Kids Act with rural Iowa school food service directors." Iowa Public Health Association Annual Meeting. Cedar Rapids, IA, April 2015. [Poster presentation].

Lillehoj, C.J., Montgomery, D., Wilson, S., Askelson, N., & **Golembiewski, E.** "A qualitative exploration of parent-child communication: Pick a Better Snack Pester Power." Annual Meeting of the Association of SNAP-Ed Nutrition Networks and other Implementing Agencies. Arlington, VA, February 2015. [Poster presentation].

Golembiewski, E.*, Askelson, N., DePriest, A., O'Neill, P., Scheidel, C., & Delger, P. "‘There Isn't Enough Bacon': Engaging high school students in the development of communication efforts to increase school breakfast participation." Centers for Disease Control and Prevention National Conference on Health Communication and Social Marketing. Atlanta, GA, August 2014. [Oral presentation].

Golembiewski, E.*, Askelson, N., O'Neill, P., Elchert, D., & Leicht, E. "It's not just school lunch. It's bigger than that: Iowa's efforts to create support for healthier school

meals.” Kentucky Conference on Health Communication. Lexington, KY, April 2014. [Poster presentation].

Askelson, N., **Golembiewski, E.***, O’Neill, P., Elchert, D., & Leicht, E. “It’s not just school lunch. It’s bigger than that: Iowa’s efforts to create support for healthier school meals.” Iowa Governor’s Conference on Public Health. Ames, IA, April 2014. [Poster presentation].

RESEARCH EXPERIENCE

National Institute of Child Health and Human Development

An interactive patient-centered consent for research using electronic medical records (Award No. R01HD086700)

08/2015-07/2019

Role: Research Assistant

Principal Investigator:
Harle, C.

Centers for Disease Control and Prevention (CDC)

Prescription drug overdose prevention for states (1U17CE002721)

3/2016-8/2019

Role: Research Assistant

Principal Investigator:
Watson, D.

Coalition for Homelessness Intervention and Prevention (CHIP)

Evaluation of the Penn Place permanent supportive housing program

1/2016-12/2017

Role: Research Assistant

Principal Investigator:
Watson, D.

National Collegiate Athletic Association (NCAA)

Wellness promotion and injury prevention among athletes: Review of risks and impact of periodization, specialization, and overuse

2015-2016

Role: Research Assistant

Principal Investigator:
Vest, J.

National Collegiate Athletic Association (NCAA)-Department of Defense (DoD) Grand Alliance

Concussion education and community-based interventions:

Implementing best practices and identifying promising approaches

2015-2018

Role: Research Assistant

Principal Investigator:
Silverman, R.

National Institute on Drug Abuse (NIDA)

Principal

Pilot testing of an e-learning strategy for Housing First implementation
(Award No. R34DA036001)
7/2014-6/2017
Role: Research Assistant

Investigator:
Watson, D.

**Substance Abuse and Mental Health Services Administration
(SAMHSA)**
PEERS (Peer Empowerment Effects Recovery Services) evaluation
(Award No. 1H79TI025460)
9/2014-9/2017
Role: Research Assistant

Principal Investigator:
Watson, D.

Iowa Department of Human Services
Integrated Health Home Medicaid demonstration program for
coordination of behavioral health and primary care services
7/2013-7/2017
Role: Research Assistant

Principal Investigators:
Momany, E.
Damiano, P.

Iowa Department of Human Services
Evaluation of Iowa Health and Wellness Plan, Health Behaviors
Program (Medicaid 115 Waiver)
06/2015-12/2017
Role: Research Assistant

Principal Investigators:
Askelson, N.
Wright, B.

Iowa Department of Human Services
Evaluation of IowaCare Medicaid Demonstration Waiver
7/2011-9/2014
Role: Research Assistant

Principal Investigator:
Damiano, P.

National Safety Council
National Driver Safety Education Campaign
12/2013-12/2016
Role: Research Assistant

Principal Investigators:
McGehee, D.
Chrysler, S.

Iowa Department of Public Health
Supplemental Nutrition Assistance Program—Education (SNAP-Ed)
state evaluation
11/2013-6/2015
Role: Research Assistant

Principal Investigator:
Askelson, N.

Iowa Department of Education

USDA Team Nutrition National School Breakfast Program (NSBP)
statewide social marketing campaign

11/2013-06/2015

Role: Research Assistant

**Principal
Investigator:**
Askelson, N.

Iowa Department of Education

USDA Team Nutrition Healthy, Hunger-Free Kids Act of 2010 social
marketing campaign

11/2013-06/2015

Role: Research Assistant

**Principal
Investigator:**
Askelson, N.

Iowa Department of Public Health

Personal Responsibility Education Program (PREP) evaluation for
Iowa

12/2011-9/2015

Role: Research Assistant

**Principal
Investigator:**
Askelson, N.

Iowa Department of Public Health

CHIPRA Children's Health Insurance Program (CHIP) outreach and
enrollment evaluation

10/2011-10/2013

Role: Research Assistant

**Principal
Investigator:**
Askelson, N.

University of Iowa Prevention Research Center for Rural Health

Supporting rural school districts in achieving school meal reforms:
Formative research for designing a diffusion of innovations-informed
intervention

4/2013-3/2014

Role: Research Assistant

**Principal
Investigators:**
Cornish, D.
Askelson, N.

American Cancer Society

Maximizing the use of health care provider influence to vaccinate
adolescents against HPV: Formative research to develop a targeted
health communication intervention for health care providers

4/2013-3/2014

Role: Research Assistant

**Principal
Investigator:**
Askelson, N.

TEACHING EXPERIENCE

Course Name	Location	Role	Term(s)
Health Administration Ethics Seminar	Indiana University-Purdue University at Indianapolis	Instructor	Spring 2019
Strategic Capability for Health Care Organizations	Indiana University-Purdue University at Indianapolis	Teaching Assistant	Fall 2018 Fall 2017

VOLUNTEERISM AND ACTIVITIES

Organization	Location	Role	Dates
AcademyHealth Student Chapter at IUPUI	Indianapolis, IN	Vice-President	2017- 2018
IUPUI Fairbanks School of Public Health PhD Student Association	Indianapolis, IN	President	2015- 2016
Iowa Department of Public Health	Des Moines, IA	Grant Reviewer	2015- 2015
Shelter House of Iowa City Homelessness Services	Iowa City, IA	Volunteer	2013- 2014
University of Iowa Counseling Services	Iowa City, IA	Student Advisory Board Member	2013- 2014
University of Iowa College of Public Health Student Association	Iowa City, IA	Service Chair	2012- 2013

National Alliance on Mental Illness (NAMI) of Johnson County	Iowa City, IA	Volunteer	2012- 2014
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WORKSHOPS AND TRAININGS

Policy Surveillance Summer Institute

Center for Public Health Law Research Temple University, Philadelphia, PA Workshop: Public Health Law Research Methods	June 2017
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Interuniversity Consortium for Political and Social Research (ICPSR)

Summer Program in Quantitative Methods of Social Research Indiana University, Bloomington, IN Course: Egocentric Network Analysis	July 2016
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Interuniversity Consortium for Political and Social Research (ICPSR)

Summer Program in Quantitative Methods of Social Research Indiana University, Bloomington, IN Course: Introduction to Network Analysis Study Design and Methods	July 2016
---	-----------

Centers for Disease Control and Prevention (CDC)

Public Health Law Program Indiana University-Purdue University Indianapolis, IN Workshop: Legal Epidemiology Techniques and Public Health Law	April 2016
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HONORS AND DISTINCTIONS

- Indiana University-Purdue University at Indianapolis (IUPUI) University Fellowship
- University of Iowa Honors in English
- University of Iowa Honors Program
- University of Iowa Dean's List

PAPER AND POSTER PEER REVIEW

- American Public Health Association Annual Meeting and Expo, *Abstract review*

- American Medical Informatics Association Annual Symposium, *Abstract review*

PROFESSIONAL MEMBERSHIPS

- AcademyHealth
- American Public Health Association (APHA)
- Iowa Public Health Association (IPHA)